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OF THE

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BULLETIN

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Article I.—ARTIONYX, A NEW GENUS OF ANCYLOPODA.

By HENRY FAIRFIELD OSBORN and JACOB L. WORTMAN.

In the last volume of this Bulletin (IV, pp. 351-371) we described a new Artiodactyl, *Protoceras*, and in the present paper we record the discovery of remains of a mammal of even greater interest. It is, so far as can be judged from the foot structure alone, a Chalicotherioid with an Artiodactyl type of foot: that is, with the astragalus, calcaneum, cuboid, all modified as in the Artiodactyla, with toes in pairs on either side of the median line, and with phalanges like those in the Carnivora. Besides these four functional toes in the hind foot there are portions of the hallux, indicating that this digit, although much smaller than the others, was still of considerable size, and provided with phalanges. Another distinctive feature is that none of the phalanges are cleft, whereas in *Chalicotherium* they are all deeply cleft.

We had anticipated finding skeletal remains of *Chalicotherium* in the Lower Miocene of America, because the teeth have recently been found both in the Lower and Upper Miocene, indicating that this form was distributed over this continent, and this foot was at first supposed to belong to *Chalicotherium*. But a closer examination showed that while *Chalicotherium* may be described as a clawed Perissodactyl, this new form, which we have named *Artionyx*, may with equal fitness be termed a clawed Artiodactyl.

Thus the group Ancylopoda must be enlarged to embrace two distinct subdivisions: the Perissonychia—animals resembling the odd-toed Ungulates in foot structure; and the Artionychia—animals resembling the even-toed Ungulates in foot structure.

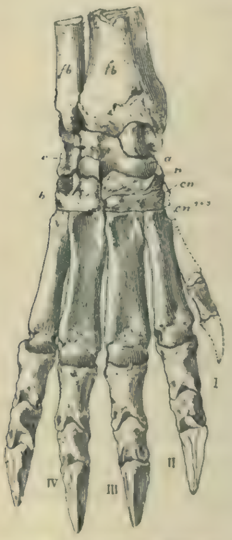

FIG. 1. *Artionyx gaudryi*, front view of right pes.

It will be remembered that the species of *Chalicotherium* have long been known under two sets of names; one set, under the genus *Chalicotherium*, being applied to its teeth, and the other, under the genera *Schizotherium*, *Macrotherium*, *Ancylotherium* and *Moropus*, being applied to its feet. Filhol, in 1888, first conjectured that these two forms might really be one. We recall also that Filhol confirmed this conjecture by his discoveries in Sansan, and that Forsyth Major arrived at the same conclusions in his explorations of Pikermi beds. Quite recently Depéret has described parts of a skeleton and skull found together at Grive St. Alban, in beds nearly contemporaneous with Sansan. It is probable that a similar confusion has arisen in this country. In 1877 Marsh described three species of *Moropus* (*distans*, *senex* and *elatus*) from the Middle and Upper Miocene of Oregon and Nebraska, considering them as large Edentates. The types consisted of a number of loose phalanges, and the author compared them with those of *Ancylotherium* (now known to be identical with *Chalicotherium*) rather than with any true Edentates; *Moropus* being considered distinct because of the coalescence of its first two phalanges. Undoubted remains of *Chalicotherium* in this country were found later by Garman in the Loup Fork (Upper Miocene), and described by Scott and Osborn. Cope has also described the teeth of a Lower Miocene species (*C. bilobatum*) from the White River beds (Swift Current Creek) of Canada. It is probable that all these species belonged to the order Ancylopoda, and as the distribution of members of this order in America and Europe is known to have been extended at least to the Siwaliks in Asia, we reach the conclusion that this order, which has become very recently known, was widely distributed in the Miocene, and, as proved by the differences between the Sansan and Pikermi forms, and still more by the differences between *Chalicotherium* and *Artionyx*, was highly differentiated. The remains known to us at present indicate, therefore, that we have mere glimpses of a very important order, the remains of which have for some reason been rarely preserved fossil.

In a recent number of the 'Revue Scientifique,"[1] Ameghino has repeated the opinion expressed in 1891[2] that the Homalodontotheridæ are the ancestors of the Chalicotheriidæ. This ancestry is impossible because *Homalodontotherium* has a typical lophodont dentition while *Chalicotherium* is buno-selenodont; it is by no means impossible, however, that this Patagonian genus is a member of the Ancylopoda. Ameghino has pointed out many features of the skeleton in which it strikingly resembles *Chalicotherium*. The carpals and tarsals are alternating or diplarthrous; there are five digits upon the robust fore and hind feet, and the ungual phalanges are shaped as in *Chalicotherium* with deep median clefts. The humerus has an epitrochlear perforation, and in general the limbs are modified as in the Edentates. The calcaneum is described as of the Litopterna type, with a very convex facet for the fibula. The head of the astragalus is extended and convex, with a nearly plane tibial trochlea. If Ameghino's supposition is correct this still further widens the distribution of the Ancylopoda.

The structure of the limbs of *Chalicotherium*, which has been mainly made known by Gervais, Filhol and Depéret, indicates that it was a digitigrade, not a plantigrade, as restored by Filhol. Osborn pointed out the perissodactyl character of the carpus and tarsus. The limbs are now completely known, and indicate that there was little or no prehensile power. It is a peculiarity of both fore and hind feet that they are turned somewhat

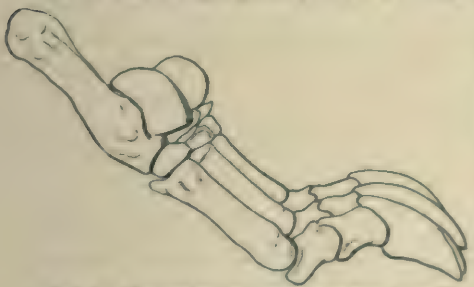

FIG. 2. *Chalicotherium magnum*, outer view of right pes (after Filhol).

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[1] Mammiferes Fossiles de la Patagonie Australe · Revue Scientifique, Jan 7th, 1893, p. 14

[2] Nuevos Restos de Mammiferos Fosiles, August, 1891, p. 9.

upon the inner side, and that the outer toes are somewhat enlarged. When *Chalicotherium* was known only by its teeth it was considered unquestionably an Ungulate; later, when the feet were connected with it, it has been considered by Filhol as bridging the gap between the Ungulates and Edentates; by Depéret as closely related to the Ungulates, and even constituting a family of the Perissodactyla; by Cope as an Unguiculate. The discovery of *Artionyx* has important bearings upon these different opinions, as well as upon the hypothesis that *Meniscotherium* is an ancestor of this group. These bearings will be discussed later.

In the present Bulletin we will give (1) a systematic description of the type, comparing it with other forms; (2) a table of the double parallelism of the Artionychia and Perissonychia; (3) a discussion of the affinities of the Ancylopoda.

I. SYSTEMATIC DESCRIPTION.

The foot of *Artionyx* seems to establish the validity of the order Ancylopoda Cope. The differences between the hind feet of this genus and of *Chalicotherium* are so fundamental that we have placed them in separate suborders, indicating by the terms proposed the double parallelism with the two great subdivisions of the *Diplarthra*. When the skeletons of these two genera become more fully known it may appear that these genera were more closely related than we now suppose, and represented merely two distinct families: the Chalicotheriidæ and Artionychidæ.

Order ANCYLOPODA *Cope.*

Phalanges of the Unguiculate type, terminating in clawed ungues. Teeth, skull, carpus and tarsus, and skeleton, so far as known, of Ungulate type.

I.—PERISSONYCHIA.[1]	II.—ARTIONYCHIA.[1]
Mesaxonic. Odd number of toes and claws. Tarsus, including astragalus, calcaneum, cuboid and navicular, of Perissodactyl type. Ungues **cleft.**	Paraxonic. Even number of toes and claws. Tarsus, including astragalus, calcaneum, cuboid, navicular and cuneiforms, of Artiodactyl type. **Ungues not cleft.**

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[1] These subdivisions are new. The Perissonychia is not equivalent to the Chalicotherioidea of Gill, because Gill proposed this term as a *superfamily* of the Artiodactyla, equivalent to the Giraffidæ, Camelidæ, Merycopotamidæ, etc. Arrang. Fam. Mamm., Smith. Misc. Coll., 1872, p. 71.

Suborder ARTIONYCHIA.

Artionyx, gen. nov.

Five complete digits, hallux reduced. Ecto- and meso-cuneiforms coalesced.

Artionyx gaudryi,[1] spec. nov.

The specific distinctions are contained in the following description and measurements of the type.

Materials Described.—The materials upon which this genus is proposed consist of the following pieces, viz.: the heads of both femora, broken away at the neck so as not to display either of the trochanters, the distal end of the left femur, including the lower half of the shaft, the patella of the left side complete, and the distal half of the right tibia and fibula, to which is articulated the pes in an almost perfect state of preservation. The only parts of the pes lacking appear to be the internal cuneiform, the metatarsal and terminal phalanx of the hallux, together with the claw of the second digit.

The specimen was obtained from the Protoceras beds or the uppermost member of the White River Miocene of South Dakota, in practically the same stratum in which our specimens of *Protoceras* were found. It was imbedded in a sandy matrix, the distal ends of the tibia and fibula and the pes being found in position almost normally articulated, so that there can be little or no doubt of the proper association of the bones herein described.

The remains pertain to a young adult in which traces of the epiphyses are still visible, and indicate an animal of the size of a full-grown pig, or perhaps a trifle smaller.

The Femur and Patella.—The head of the femur is quite remarkable for its extreme globular form. It represents somewhat more than the half of a sphere, and is marked by a deep pit for the insertion of the ligamentum teres. The shaft of the distal half of the bone is somewhat crushed, but its form is sufficiently well preserved to enable us to state that it is considerably flattened from before backwards, especially in its lower portion. In this respect it differs from both the Artiodactyle and Perissodactyle Ungulates, in which the shaft is almost circular in section, with a marked tendency to become more or less quadrangular in sections in its extreme distal portion.

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[1] This species is named in honor of the celebrated French palæontologist Professor Albert Gaudry.

The femoral condyles, and in fact the whole distal extremity of the bone, partake of the nature of the shaft, and are relatively much flattened from before backwards, in marked contrast with the backwardly projecting condyles of both the Artio- and Perissodactyla. The rotular groove is placed upon the anterior face of the bone rather than under the extremity of the shaft, as in the two orders above mentioned. Its direction is somewhat oblique to the outer side of the shaft, as in the tapir, differing in this respect from the pig, in which it is almost straight.

The condyles have comparatively little backward extension, the extremity of the inner one occupying a slightly lower plane than the outer. The intercondylar notch is correspondingly wide and shallow, and it is not overhung by the internal condyle as in hoofed orders.

The patella is relatively small and more elongated than in either the pig or the tapir, but does not otherwise present any points of especial interest. The whole structure of this part of the knee-joint would seem to indicate that the femur was little bent upon the crus, and that the limb was more like that of the elephant in the matter of its straightness than of either the pig or the tapir.

The Tibia and Fibula.—Unfortunately the proximal ends of these two bones are not preserved, so that their description cannot be given at the present writing. In the lower half of its extent the shaft of the tibia may be said to be more or less trihedral in form, expanding distally somewhat to support the articular extremity which it offers to the astragalus.

The internal malleolus is remarkable for its development and the manner in which it articulates with the astragalus. It is long, stout, and slightly hook-shaped, reaching at least half-way down the inner side of the astragalus when the bones are placed in position. The hook is directed to the outer side of the ankle, and is received into a deep excavation upon the inner face of the ankle bone. In the pig the internal malleolus is small and overlaps the inner side of the astragalus but slightly, but in *Oreodon* it is much larger and overlaps the astragalus considerably. It also has a tendency to become hook-shaped in this form. The remainder of the articular surface is shaped very much as in the pig, being deeply grooved to receive the condyles of the astragalus, with a median tongue or ridge which fits accurately into the intercondylar groove of this latter bone.

The shaft of the fibula, so far as it is preserved, is slender and much flattened. Its distal extremity is expanded to a greater extent than in the pig, and, as in all the Artiodactyla, it articulates with both the astragalus and calcaneum. The articular surface, by means of which it joins the astragalus, consists of a beveled edge upon the upper outer surface of the external condyle of this bone, anteriorly. In the Artiodactyla, owing to the vertical dimensions of the astragalus, the fibula overlaps it considerably, so that the articulation between these two bones is confined entirely to the outer side of the astragalus.

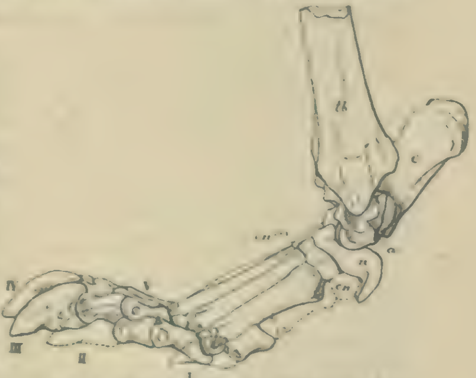

FIG. 3. *Artionyx gaudryi*, inner view of right pes (⅔ nat. size).

Tarsus.—The tarsus presents so many striking resemblances to that of the Artiodactyle Ungulates that its description is perhaps best accomplished by instituting a comparison between it and some generalized members of this order, of which the pig is a good example.

The *astragalus* is relatively broader and of less vertical depth than that of the boar. This results from the shortness of the neck and the inward extension of the navicular portion of the head. Its superior or trochlear surface presents two unequal condyles, strongly convex from before backward, and separated by a deep groove. The external condyle, the larger of the two, is limited in front by a deep transverse notch which separates it sharply from the cuboidal facet, in front or below. This notch is much more pronounced than in the astragalus of the pig. The inner condyle is smaller and presents a somewhat sharper crest, owing to the excavation of its inner side for articulation with the internal malleolus. In its lower or anterior extremity it is well rounded, and of a somewhat scroll-like pattern, terminating abruptly in a distinct overhanging ledge, which separates it from the navicular facet. This ledge is absent from the astragalus of the boar, as is also the scroll-like appearance of the lower part of the condyle, but traces of it are to be seen in *Oreodon*. The distal extremity or head of the astragalus is occupied by two facets for articulation with the cuboid and navicular. It joins the trochlear portion by a short neck, and is placed quite as obliquely upon this part of the bone as in that of the suillines. The cuboid and navicular facets are strongly convex from before backwards, and in their articulation with these bones form as perfect a ginglymus as is to be seen in any of the Artiodactyla. They are sharply separated from each other by a prominent fore and aft ridge, which passes backwards to form the inner boundary of the sustentacular facet behind. The cuboid facet is the smaller of the two and can be said to have but a limited extension backwards. It narrows greatly at the middle of the under or anterior surface, and becomes continuous with the sustentacular facet behind. In the pig, and to a somewhat less extent in *Oreodon*, it is continued well around to the posterior surface, but it is separated from the sustentacular facet by a well-marked ridge. This facet, while it is strongly convex from before backwards, is little or not at all concave from side to side. The navicular facet on the other hand is not only very convex fore and aft, but presents first a convexity and then a marked concavity laterally from within outwards, as in the pig. One feature in which it differs markedly from the astragalus of the pig, and for that matter, of all the Artiodactyla, is its great backward extension, reaching as far as the middle of the posterior surface of the bone. By reason of this backward extension of the navicular facet, the facet for the *sustentaculum tali* is very oblique and beveled considerably externally. It covers the larger part of the posterior surface of the bone.

The *calcaneum* resembles the corresponding bone of the pig very closely. This is especially noticeable in the small sustentaculum, the narrow distal extremity where it articulates with the cuboid, together with the prominent articular face by which it articulates with the fibula. As compared with that of the pig, the tuber is relatively shorter, the distal end is somewhat narrower, and the fibular facet has a greater antero-posterior extent. Upon the outer side just below the fibular facet is a prominent bony ridge for the attachment of the external lateral ligament, beneath which is a shallow fossa which is scarcely indicated in the calcaneum of the boar. Upon the end of the tuber is seen a well-marked groove, located somewhat to the inner side, which serves for the passage of the tendon of the *plantaris* muscle.

The *cuboid*, as compared with that of the pig, is much depressed. Posteriorly it bears a process of moderate dimensions as in the Artiodactyla in general. Upon its upper surface are the two facets for the calcaneum and astragalus, that for the calcaneum being almost flat and inclined downwards and forwards, while the astragalar facet is strongly concave. Distally two facets can be distinguished for articulation with the fourth and fifth metapodials respectively. They are relatively broad and flat. At the posterior edge of these articular surfaces, immediately beneath the backwardly projecting bony process, is to be seen a slight groove for the passage of the long peroneal tendon as it crosses the plantar surface of the foot. This groove is especially well developed in the pig, being almost completely converted into a foramen. In *Oreodon* it is less developed.

The *navicular* is also much flattened from above downwards, resembling in this respect the corresponding bone of the Perissodactyla, rather than that of the Artiodactyla. It is strongly cup-shaped above to receive the convex navicular portion of the head of the astragalus, and much flattened below where it articulates with the coössified ecto- and meso-cuneiforms. Upon its inner face is seen a moderately weak *tuberculum*, to which the tendon of the anterior tibial muscle (*tibialis anticus*) is attached. Its chief peculiarity is found however in the enormous hook which is developed upon its posterior surface. This hook is broad, much flattened from behind, and completely overhangs the ectomeso-cuneiform, as well as the proximal ends of the neighboring metapodials. Although less prominent it appears to be universally present in the Artiodactyla and as universally absent in the Perissodactyla.

Features of the Double Ginglymus.—It is interesting to note in this connection, and a matter of no slight significance, that a similar hook is developed upon the navicular of the lagomorph rodents. In this widely separated group we also find that the foot is of the paraxonic type, that the fibula articulates with the calcaneum, and that there is a distal ginglymus present (astragalo-navicular). It would thus appear that these characters, arising as they have independently, in at least three distinct and widely separated orders, are necessary concomitants, and dependent upon the same or similar causes for their production. (See Appendix.)

The *ecto-* and *meso-cuneiforms* are completely coössified, there being no trace of the suture visible. This compound bone is broad and flat, and rests upon the second and third metapodials. The articulation with these bones is by a broad flattened surface, which is also true of the articular surface by which it supports the navicular. When the cuneiform and navicular are articulated there is seen a somewhat cup-shaped facet upon the inner side of these two bones, which undoubtedly indicates the existence of an internal cuneiform, although this bone is not preserved.

The Metatarsus.—The metatarsus consists of five elements, of which three are arranged upon the inner and two upon the outer side of the median axis. The metatarsal of the hallux is not preserved, but the presence of the first phalanx of this digit, together with a facet for a distinct and well-developed internal cuneiform, already mentioned, renders it quite certain that the hallux was present, though small. In the drawing its length has been estimated from the length of the phalanx.

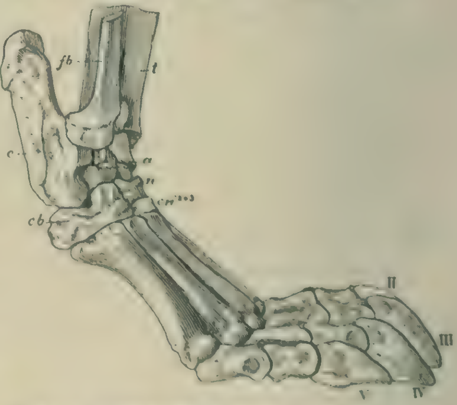

FIG. 4. *Artionyx gaudryi*, outer view of right pes (⅔ nat. size).

Of the remaining metatarsals, the two median ones, mts. III and IV, are almost if not quite equal in size and length. The lateral ones, mts. II and V, are practically so, the disparity in their length being slightly greater than that found in the pig. While the outer one (mt. V) is a little the longer of the two, the inner one (mt. II) is the stronger. This appears also to be true of all the more generalized Artiodactyla in which four toes are present. In the rabbit, on the other hand, mt. II, is both longer and stronger than mt. V, and this is also true of the median pair, the inner one slightly exceeding its fellow in size and length.

The two outer metatarsals (IV and V) are supported wholly by the cuboid, while the two inner ones (II and III) are supported by the compound cuneiform. Just as in the lower Artiodactyla and in the rabbit there is no tendency to displacement of any of the metapodials. The distal ends of the metapodials have prominent well-rounded articular heads, very similar to those of the digitigrade Carnivora. These facets are continued well backward upon the dorsal surface, and are constricted off from the shafts by deep grooves, indicating that the main flexure of the foot took place at this point, as figured by Gaudry in *Chalicotherium*, and that the animal was truly digitigrade. Distal keels are present, but are confined to the plantar surface.

The Phalanges. — The proximal phalanges are quite remarkable for the character of the articular surfaces by which they join the metapodials. When looked at from the side these surfaces are seen to be directed more upwards than backwards, almost to the same extent as represented by Gaudry in *Chalicotherium* (Fig. 5, *A*). This indicates two things, viz.: that the proximal ends of the metapodials were raised from the ground, and that the distal end of the phalanx was carried slightly upwards when the bones were placed in their natural

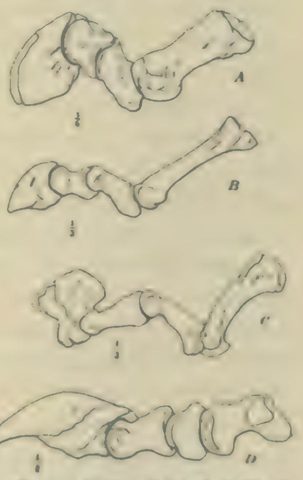

Fig. 5. Median digits of, *A*, *Chalicotherium sansaniense* Gaudry. *B*, *Artionyx gaudryi*. *C*, *Hoplophoneus occidentalis*. *D*, *Megalonyx jeffersonii* (after Leidy).

position. This view is further carried out by the character of the articular surface at the distal end of the phalanx. It is directed more downwards than forwards, which would give the succeeding phalanx a downward trend again, so that the first two phalanges would describe a gentle curve. This is well exemplified in the cat (Fig. 5, *C*). The second or median phalanges are shorter than the proximal, and are more compressed from side to side. Distally they exhibit a grooved articular surface almost equally divided between the upper and lower moieties of the bone, for articulation with the large compressed claws or ungues. There is nothing to indicate that the ungues were strongly bent down upon the middle phalanx, as represented by Gaudry. If one can imagine a digitigrade bear it would come very near representing the manner in which the phalanges were articulated in *Artionyx*.

The ungues are large, strongly compressed, and considerably arched upon the dorsal surface. They are a little hook-shaped. The proximal ends are deeply excavated (representing almost a semicircle), to receive the distal ends of the median phalanges. There is no trace of a bony sheath or a median cleft developed.

SUMMARY.—The principal characters of the genus described above may be summarized as follows: (1) Extreme globular form of the *caput femoris*. (2) The slight backward extension of the femoral condyles. (3) The great development of the internal malleolus, and the excavation upon the inner side of the astragalus. (4) The articulation of fibula with calcaneum. (5) The articulation of astragalus with cuboid and navicular, and the formation of a distal ginglymus. (6) The slight extension backwards of the cuboidal facet on the astragalus and its continuity with the sustentacular facet. (7) The great backward extension of the navicular facet, and the obliquity of the sustentacular facet. (8) The weak development of *sustentaculum tali*. (9) The marked depression of the cuboid, navicular, and cuneiforms. (10) The presence of a tuberculum upon the inner border of navicular. (11) The presence of a prominent navicular hook. (12) Coössification of ecto- and meso-cuneiform. (13) Presence of internal cuneiform and hallux. (14) The foot of the paraxonic type. (15) The metatarsals are not displaced upon the tarsals.

(16) The distal keels of metapodials confined to plantar surface. (17) The ungues large, much compressed, and little hooked. (18) Presence of a groove upon the end of the tuber of the calcaneum.

In the table on page 14 we give a list of the principal characters exhibiting the double parallelism of the Ancylopoda to the Diplarthra.

III.—AFFINITIES OF *Chalicotherium* AND *Artionyx.*

Prior to this discovery, four views were advanced as to the affinities of the Chalicotheridæ. First, that the Chalicotheridæ were a specially modified family of Perissodactyla; first based upon the teeth, then upon the teeth and podials by Osborn (5[1]); then upon the entire structure by Depéret (2). Second, that this group bridges the gap between the Ungulates and Edentates, suggested by Filhol, at the time of his discovery (3). Third, that the family belonged to a distant order (Ancylopoda) of the Unguiculata, suggested by Cope (1). Fourth, that it was derived from the Condylarthra (Meniscotheriidæ) or primitive Ungulata, as suggested by Osborn (5).

Edentate Hypothesis.—The main points advanced by Filhol in favor of his hypothesis are the loss of the cutting teeth and the peculiar modifications of the limbs. But the molar type is fundamentally different from that in the Edentata, and the loss of the cutting teeth is not significant. Gaudry and Gervais have shown that the modification of the phalanges is fundamentally unlike that in the Edentates. And Depéret in his thorough discussion of the entire skeleton has finally disposed of this hypothesis by proving first that the skeleton is mainly Ungulate in type, and second that the modifications of the arm and leg are independent parallel adaptations, the Edentate likeness being merely superficial. The cleft terminal claw, which suggested to Cuvier the term "Pangolin gigantesque," we may add, is not exhibited in *Artionyx.*

Unguiculate Hypothesis (Cope).—In a purely descriptive sense both *Chalicotherium* and *Artionyx* are "unguiculate," but in a phyletic sense the problem is whether in their entire structure these animals stood near the Unguiculata. The truth is, the

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[1] The numbers in this paragraph refer to the Bibliography at the end of the paper.

ARTIONYCHIA.	ARTIODACTYLA.	PERISSONYCHIA.	PERISSODACTYLA.
(1) Fibula articulating with calcaneum.	(1) Same.	(1) Fibula not articulating with calcaneum.	(1) Same.
(2) Tarsus with double ginglymus.	(2) Same.	(2) Tarsus with single ginglymus.	(2) Same (except in *Litopterna*).
(3) Astragalus narrow, sustentaculum small.	(3) Same.	(3) Astragalus broad, sustentaculum large.	(3) Same.
(4) Navicular with strong posterior hook.	(4) Same.	(4) Navicular without posterior hook.	(4) Same.
(5) Foot of the paraxonic type. Axis between mts. III and IV.	(5) Same.	(5) Foot of the mesaxonic type. Axis through mt. III.	(5) Same.
(6) Metatarsals not displaced on tarsals.	(6) Same.	(6) Metatarsals displaced on tarsals.	(6) Same.
(7) Terminal phalanges unguiculate, uncleft.	(7) Terminal phalanges ungulate.	(7) Terminal phalanges unguiculate, cleft.	(7) Terminal phalanges ungulate.

unguiculate characters, so far as we know at present, are confined to the phalanges. All the other characters are Ungulate. This is as true of the foot of *Artionyx* as it is of the limbs, skull and teeth of *Chalicotherium*. Is it not more probable that the phalanges secondarily acquired an unguiculate structure, rather than that all the remainder of the skeleton passed from an Unguiculate into a pronounced Ungulate type?

Perissodactyl Hypothesis.—Depéret's view that the Chalicotheridæ are modified Perissodactyla is not supported by a detailed comparison of the skull of *Chalicotherium* with that of the older Perissodactyls, for this skull is of a much less modified type, and is distinctly non-perissodactyl in the several features enumerated below, in which it does resemble the skulls of the ancient Condylarthra. Moreover the discovery of *Artionyx* indirectly strengthens Cope's view that *Chalicotherium* belongs to a distinct order. Let us therefore look at the broader question of its relationships to the primitive Ungulata.

Primitive Ungulate Hypothesis.—Exhibiting the affinity of *Chalicotherium* to the Ungulates in general are many features in the limbs, specified by Depéret in support of his Perissodactyl view. The dentition especially bears a most detailed resemblance to that of *Meniscotherium*, which we know to be a Condylarth. The skull is very suggestive of the type seen in *Periptychus*, *Phenacodus* and *Meniscotherium*, in its low, broad occiput, small cranium, well-arched sagittal crest, high maxillary bones, widely open external auditory meatus. It has also the Ungulate conformation of the posterior region of the jaw, the elevated condyle and deep angles, also seen in the oldest Condylarthra.

Mingled with these ancient characters we see many secondary modifications adapted to the peculiar semi-arboreal habits of the animal, probably associated with a long tongue and highly flexible upper lip. Such are the loss of the upper incisors, semi-procumbent position of the lower incisors, the deep recession of the anterior nares, the reduction of the premaxillaries and of the anterior portion of the lower jaw, paralleled by similar modifications among the sloths. One secondary feature of the skull is, so far as we know, unique, that is the large curved cylindrical tympanic bullæ.

Artionyx strengthens the Ungulate hypothesis by its foot structure, but raises a fresh difficulty in the wide differences which it exhibits from *Chalicotherium*. Is it possible, as Scott has suggested to us, that *Artionyx* represents a primitive offshoot of the Artiodactyla, as *Chalicotherium* may be of the Perissodactyla? In such a case we must suppose that these two series independently acquired claws. The main difficulty, of course, with the Ungulate hypothesis is the retrogression from hoofs to claws which it at first sight requires. But we may suppose that the divergence took place before the ungues were hoofed, while they were still subungulate or nailed as in *Meniscotherium*.

Affinities of Meniscotherium.—We have already spoken of the likeness between the *Meniscotherium* and *Chalicotherium* dentition. This question is fully discussed by Osborn in another paper. *Meniscotherium*, like *Chalicotherium*, has the central digit enlarged; this would remove it from the ancestry of *Artionyx*. On the other hand, *Meniscotherium* has the fibulo-calcaneal facet, and deep pit upon the astragalus for the internal malleolus of the tibia which we observe in *Artionyx*. The terminal phalanges of *Meniscotherium* are subungulate, as in the Primates. Thus the feet of *Meniscotherium* bear resemblances to those of both *Chalicotherium* and *Artionyx*, but not of sufficient closeness to enable us to consider it at present as an ancestral type.

CONCLUSIONS.—The general conclusion is that the suggested affinity of the Chalicotheridæ to the Meniscotheriidæ is in some degree supported by the discovery of *Artionyx*, although it is somewhat hazardous to place too much reliance upon this hypothesis until we procure the teeth and other portions of the skeleton of this genus. Taking together the condylarthrous character of the skull and the predominant ungulate facies of the skeleton, and our knowledge of these affinities to *Meniscotherium*, we have a presumption in favor of the idea that the Ancylopoda issued from the Ungulata after the ungulate direction had been given to their evolution, but before they had fully acquired the distinctively ungulate phalanges. The double parallelism, so marked in each case, between the Artionychia and Perissonychia and the respective divisions of the Diplarthra is still a very difficult fact to account for, and we trust that additional remains of both these types may soon be discovered.

Appendix.

THE MECHANICS OF THE ARTIODACTYL TARSUS.

A careful study of the anatomy and movements of the ankle joint in a dissection of the hind foot of a deer, in comparison with the pig and hippopotamus, reveals the following important facts, viz: (1) the movement of the tibia and fibula upon the astragalus is comparatively limited, the proximal ends of these bones passing through an arc of only 90° in extreme flexion and extension. An additional 90° of arc is secured by the movement of the astragalus upon the calcaneum and navicular, so that by these combined movements the complete flexion of 180° of the pes upon the crus is possible. Now the articular facet upon the posterior facet of the astragalus is quite oblique, so that its movement upon the calcaneum causes a decided torsion or lateral movement of the calcaneum. (2) This torsion is from within outwards, and in order to prevent displacement of the calcaneum, a strong ligament is developed, stretching from the entire under or plantar surface of the calcaneum to the posterior border or hook of the navicular. Powerful extension of the pes upon the crus, as must necessarily occur in the act of leaping, causes this ligament to become very tense. Both the torsion and the navicular hook are absent in the Perissodactyla. (3) Another marked feature of the Artiodactyle calcaneum is the groove developed upon the top of the tuber, through which the tendon of the *plantaris* glides, as it passes into the sole of the foot to become the perforated tendon. This groove is present in all the Artiodactyla, in *Artionyx*, and the Lagomorpha, but is absent in the Perissodactyla. Its presence seems to indicate a more specialized condition of the *plantaris* in these forms than in the Perissodactyla, but it is difficult to see in what manner it is associated with the foot structure. It is merely mentioned in this connection because of its constant occurrence. (4) In the Perissodactyla there is little or no movement between calcaneum and astragalus, and the strong calcaneo-navicular ligament is wanting. In the Lagomorpha, on the other hand, there is extensive movement between the calcaneum and astragalus, and both the navicular hook and the ligament are present. The marked resemblances of the pes of the rabbit to that of the Artiodactyla have been noted elsewhere. It would thus appear, if we attempt to explain the presence of the navicular hook upon a mechanical basis, that in proportion as there was greater and greater mobility developed between astragalus and calcaneum, increasing torsion of the calcaneum followed as a result of the oblique facets between these bones. This in turn gave rise to special stress or strain upon that portion of the plantar fascia which invests this region of the foot, resulting in the production of the specialized calcaneo-navicular ligament. The hook or process of the navicular has been developed to give greater surface of attachment for this important ligament.

(5) Another interesting fact connected with the mechanics of the tarsal joint is found in the peculiar rotation which the foot makes when the calcaneum is fixed and the tibia is flexed or extended upon the pes. In this case the torsion movement of the calcaneum is transferred to the foot, and it is seen to be distinctly rotated outwards when the metatarsals are approximated to the anterior surface of the tibia as in extreme flexion. Now it is in this outwardly rotated position that the foot strikes the ground in the act of running, so that there would be, therefore, a constant tendency to throw a considerable part of the weight upon the fourth digit. It is conceivable that it is to this cause that we can attribute the shifting of the median axis of the pes from the center of the third digit (mesaxonic) to a line between the third and fourth digits (paraxonic), as well as the selection of the fourth to pair with the third in the cloven foot. This, of course, is assuming that the mesaxonic type of foot is the primitive one for the Ungulate series.

We are as yet unacquainted with a five-toed Artiodactyle pes, but so far as the number of digits is concerned, we have in *Artionyx* a primitive condition. It is thus especially interesting to note the great advance in the perfection of the tarsal articulations over the digital reduction. It would appear therefore, and it will doubtless eventually be found, that the first important step, and as I am inclined to believe the primary cause, in the modifications which have led up to the production of the Artiodactyle pattern of foot, has been the increased mobility of the astragalus upon the calcaneum, cuboid and navicular, associated with the obliquity of the astragalo-calcaneal joint.—J. L. W.

Recent Bibliography.

1. Cope.—The Vertebrata of the Swift Current River, II. <*American Naturalist*, March, 1889, p. 151 (species *C. bilobatum*, order Ancylopoda).
2. Depéret.—La Faune de Mammifères Miocènes de la Grive-St. Alban. <Arch. Mus. d'Hist. Nat. d'Lyon, 1892.
3. Filhol.—Assoc. Franç. Congrès Toulouse, 1888, p. 265.
   Mammifères de Sansan. <Ann. Sc. Gèol., 1891, pp. 294–300. pll. 43–46.
4. Gaudry.—Journ. de Zool., 1875, pl. 18 (*Schizotherium priscum*).
   Les Enchainments du Monde Animal, 1878, pp. 194–198.
   Fauna Attica, pp. — —.
5. Osborn.—Chalicotherium and Macrotherium. <*American Naturalist*, 1889, p. 729.
   Meniscotheriidæ and Chalicotherioidea. <*American Naturalist*, Oct., 1891, pp., 911.
   Is Meniscotherium a Member of the Chalicotherioidea. <*American Naturalist*, June, 1892, p. 507.
   The Ancylopoda, *Chalicotherium* and *Artionyx*. *American Naturalist*, Feb., 1893. (In press.)

Article II.—NOTES ON SOME NORTH AMERICAN MOTHS, WITH DESCRIPTIONS OF NEW SPECIES.

By William Beutenmüller.

The following studies of some North American moths are chiefly based upon material in the collection of the Museum, and upon some unpublished notes made by the late Henry Edwards on types in the collection of the British Museum.

BOMBYCIDÆ.

Euhyparpax, n. gen.

Primaries twice as long as broad; costa almost straight, very slightly concave about the middle; apex pointed; outer margin slightly rounded; inner angle obliquely rounded. Secondaries reaching to the inner angle of the primaries, apex acutely rounded, outer margin almost oblique, hind angle rounded. Body (♂) slender, extending beyond the secondaries; anal tuft obsolete. Legs pilose, femora and tibiæ covered with long ciliated hairs, tarsi covered only with very short scales. Head depressed, palpi very short and barely visible owing to the scales covering the same and the thorax. Antennæ half as long as the primaries, stalk stout, with the pectinations to about the middle of equal length, when they very gradually decrease in length to about two mm. before the apex, which portion is without pectinations. The genus is allied to *Hyparpax*.

Euhyparpax rosea, n. sp.

Head, thorax and body pale ochreous, slightly tinged with pink. Primaries pinkish ochreous, inclined to be rose-colored, with a very narrow undulated transverse line of a deeper color beyond the middle of the wing. This line is somewhat curved before reaching the costa. Beyond this line before the outer margin is a row of very indistinct spots of the same color. At the end of the discal area is a faint indication of an ochreous spot. Secondaries rose-colored, with the cilia paler. Undersides of all the wings wholly rose color, without any markings. The legs and body are also tinged with pinkish. Stalk of antennæ, above, whitish with the pectinations deep ochreous, of which color are also the antennæ beneath. Expanse of wings, 40 mm.

One male, West Cliff, Custer Co., Colorado (T. D. A. Cockerell). Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Arctia radians (*Walker*).

Apantesis radians WALKER, Cat. Lepid. Br. Mus. pt. III, 1855, p. 632.
Arctia radians SMITH, Can. Ent. Vol. XXIV, 1892, p. 134.

The late Hy. Edwards's note on the type of this insect is as follows: "Is the black form of *nais* with red base to secondaries, and a dash of pale ochre on base of primaries."

Arctia rhoda *Butler*.

Arctia rhoda BUTLER, Ent. Mo. Mag. Vol. XVIII, p. 135; SMITH, Can. Ent. Vol. XXIV, 1892, p. 134.

This is the common form of *A. nais* with pink under wings, according to Edwards's unpublished note on the type in the British Museum. Prof. Smith, who also examined the type of *A. rhoda*, likewise refers it to the common form of *A. nais*.

Arctia simplicior *Butler*.

Arctia simplicior BUTLER, Ann. Mag. Nat. Hist. Vol. VIII, 1881, p. 311.

According to Mr. Edwards's unpublished note on the type of this species, it is the female of *Arctia achaia*.

Antarctia walsinghamii *Butler*.

Antarctia walsinghamii BUTLER, Ann. Mag. Nat. Hist. Vol. VIII, 1881, p. 311; SMITH, Can. Ent. Vol. XXIV, 1892, p. 135.

Prof. Smith says this is a strongly marked, deeply tinted *A. rubra*. Mr. Edwards's note on the type is as follows: "Is the very red female of *A. punctata*."

Phragmatobia dubia (*Walker*).

Cynia dubia WALKER, Cat. Lepid. Br. Mus. pt. III, 1855, p. 682.
Phragmatobia dubia GROTE & ROBINSON, Trans. Am. Ent. Soc. Vol. II, 1868, p. 72; SMITH, Can. Ent. Vol. XXIV, 1890, p. 120.

Described as *Cynia dubia* by Walker, but placed in the genus *Phragmatobia* by Grote and Robinson. Mr. Edwards saw the type in the British Museum, and his note on the insect says "A good species. But the genus is near *Antarctia*. Habitat: Hudson's Bay."

Halisidota strigosa *Walker.*

Halisidota strigosa WALKER, Cat. Lepid. Br. Mus. pt. III, 1855, p. 736.
Halisidota laqueata HY. EDWARDS, Ent. Am. Vol. II, 1886, p. 166.

Mr. Edwards examined the type of *H. strigosa*, and refers this species to his *H. laqueata*. I have compared Walker's description with the type of *H. laqueata*, and cannot find any differences.

Habitat: St. Domingo (Walker); Texas (Edwards).

Orgyia leucostigma var. **obliviosa** *Hy. Edwards.*

Orgyia leucostigma var. *obliviosa* HY. EDWARDS, Ent. Am. Vol. II, 1886, p. 13.

This variety is nothing more than the spring form of the common *Orgyia leucostigma*. The late S. Lowell Elliot bred *obliviosa* from larvæ which he collected in June, and *leucostigma* from identical larvæ collected in September.

The form *obliviosa* differs from the fall brood by being smaller and much paler in color, with the markings less distinct. The female is said by Hy. Edwards to be also considerably smaller, but the specimens bred by Mr. Elliot are the same size as those bred from the autumn larvæ.

Twenty males, five females, from June larvæ; six males, nine females, from September larvæ. Coll. S. L. Elliot. Types of *obliviosa*: three males and two females, New Jersey. Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Cossus populi *Walker.*

Cossus populi WALKER, Cat. Lepid. Br. Mus. pt. VII, 1856, p. 1515.

"Unknown to me. It has no black band, but diffused waved striæ over the wings." (Edwards, unpublished notes.) Habitat: St. Martin's Falls, Albany River, Hudson's Bay (Walker).

Cossus plagiatus *Walker.*

Cossus plagiatus WALKER, Cat. Lepid. Br. Mus. pt. VII, 1856, p. 1515.

Mr. Edwards's unpublished note on the type says, "Rather small. Have no doubt but that the type specimen is the same as the female of *C. robiniæ*."

ÆGERIIDÆ.

Tarsa denudata (*Harris*).

Trochilium denudatum HARRIS, Am. Journ. Sc. and Art, Vol. XXXVI, p. 310, 1839; Ins. Inj. Veget. 1st Edit. 1841, p. 231; *ibid.* 2d Edit. 1852, p. 252; *ibid.* 3d Edit. 1862, p. 330; MORRIS, Syn. Lepid. N. Am. 1862, p. 138 (quotes Harris); KELLICOTT, Can. Ent. Vol. XIII, 1881, p. 8.
Ægeria denudatum PACKARD, Ins. Inj. For. and Sh. Trees, 1881, p. 138.
Fatua denudata HY. EDWARDS, Papilio, Vol, II, 1882, p. 97; BEUTENMÜLLER, Ann. N. Y. Acad. Sc. Vol. V, 1890, p. 204; SMITH, Cat. Ins. N. J. 1890, p. 288; PACKARD, 5th Rep. U. S. Ent. Com. 1890, p. 540.
Tarsa bombyciforms WALKER, Cat. Lep. Br. Mus. pt. VIII, 1856, p. 61.

Mr. Edwards's note says, "Walker's species is the male of *Fatua denudata* Harr." Mr. Edwards was acquainted with the types of both these species, consequently there can be no question as to their identity. The generic name *Fatua*, proposed by Mr. Edwards, has been previously employed in the Coleoptera, and therefore cannot stand. Walker's genus *Tarsa* would, however, have precedence over the name *Fatua*, having been established many years previous.

Bembecia marginata (*Harris*).

Trochilium marginatum HARRIS, Am. Journ. Sc. and Arts, Vol. XXXVI, 1839, p. 309; MORRIS, Syn. Lepid. N. Am. 1862, p. 137.
Sphecia? marginata WALKER, Cat. Lep. Br. Mus. pt. VIII, 1856, p. 12.
Bembecia marginata HY. EDWARDS, Ins. Inj. Forest and Sh. Trees, 1881, p. 261; Papilio, Vol. II, 1882, p. 52; SAUNDERS, Ins. Inj. Fruit, 2d Edit. 1889, p. 303; KELLICOTT, Journ. Columbus Hort. Soc. Vol. V, 1890, p. 27; BEUTENMÜLLER, Ann. N. Y. Acad. Sc. Vol. V, 1890, p. 204; SMITH, Insect Life, Vol. IV, 1891, p. 29; Bull. N. N. J. Agricul. Exp. Station 1891, p. 9; Rep. Ent. N. J. 1891, p. 378; KELLICOTT, Can. Ent. Vol. XXIV, 1892, p. 44.
Ægeria odyneripennis WALKER, Cat. Lepid. Br. Mus. pt. VIII, 1856, p. 42; HY. EDWARDS, Papilio, Vol. I, 1881, p. 206.
Ægeria rubi RILEY, Sixth Rep. Nox. Ins. Missouri, 1874, p. 111; MARTIN, Fifth Rep. Nox. Ins. Illinois, 1881, p. 108; SAUNDERS, Ins. Inj. Fruit, 1st Edit. 1883, p. 313.
Sesia flavipes HULST, Bull. Brooklyn Ent. Soc. Vol. III, 1881, p. 76.

The type of *Ægeria odyneripennis* Walker was examined by the late Henry Edwards, and his note upon this species says: "*Bembecia odyneripennis* Walk. is the same as *B. marginata* Harris." I have carefully compared specimens of *B. marginata* with Walker's description and Edwards's figure of the type of *B. odyneripennis* (Papilio, Vol. I, pl. i, fig. 3), and find that these do not differ.

Bembecia marginata var. **albicoma** *Hulst.*

Bembecia marginata var. *albicoma* HULST, Bull. Brooklyn Ent. Soc. Vol. VI, 1883, p. 8.

Differs from the type form by having the bands on the abdominal segment whitish instead of yellow, and by being somewhat darker in color. For some reason this variety was omitted from our lists.

Type: One male, Long Island, N. Y. Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Bembecia pleciæformis (*Walker*).

Ægeria pleciæformis WALKER, Cat. Lep. Br. Mus. pt. VIII, 1856, p. 40; HY. EDWARDS, Papilio, Vol. I, 1881, p. 206.

According to Mr. Edwards's notes, this is a good species. The figure of *B. pleciæformis* (Papilio, Vol. I, pl. i) does not agree with Walker's description. It lacks the yellow bands on the abdominal segments, and also the yellow stripes on each side of the thorax.

Habitat: Nova Scotia (Walker).

Bembecia emphytiformis (*Walker*).

Ægeria emphytiformis WALKER, Cat. Lep. Br. Mus. Vol. VIII, 1856; HY. EDWARDS, Papilio, Vol. I, 1881, p. 206.

Mr. Edwards's note says: "Unknown to me. It is a good species." A figure of the insect was published by Mr. Edwards in 'Papilio,' Vol. I, pl. i, fig. 1. It is totally unlike any Ægerian known to me. The habitat given by Walker for the insect is "United States."

Albuna hylotomiformis (*Walker*).

Ægeria hylotomiformis WALKER, Cat. Lepid. Br. Mus. pt. VIII, 1856, p. 43; HY. EDWARDS, Papilio, Vol. I, 1881, p. 206.
Albuna hylotomiformis HY. EDWARDS, Papilio, Vol. I, 1881, p. 186.

On the type of this species in the British Museum, Mr. Edwards made the following note, "Is a good species and is unknown to me."

Habitat: Nova Scotia (Walker).

Sciapteron denotata (*Hy. Edwards*).

Albuna denotata Hy. Edwards, Papilio, Vol. II, 1882, p. 55.

Was described by Mr. Edwards as an *Albuna*, but the strongly pectinated antennæ and other characters place it in the genus *Sciapteron*, and the type was so labeled by Mr. Edwards. A single female was taken by Mrs. Slosson, at Franconia, New Hampshire. Previously it was only known from Montana.

Sannina uroceriformis *Walker.*

Sannina uroceriformis Walker, Cat. Lep. Br. Mus. pt. VIII, 1856, p. 64.

Mr. Edwards at one time considered this species to be identical with *Sannina exitiosa*, and it is so placed in our lists. His unpublished note on the type of this insect, which was examined by him, in the British Museum, says: "Neither the male or female of *S. exitiosa*. An entirely new species, with a red band on the abdomen, and looking like the female of *Phemonoë quinquecaudata* in general appearance."

Habitat: United States (Walker).

Ægeria bassiformis *Walker.*

Ægeria bassiformis Walker, Cat. Lepid. Br. Mus. pt. VIII, 1856, p. 39.

"This is a good species and not *Podosesia syringæ* Harr. as I thought. It is very like *Ægeria lustrans* Gr., but blacker. This may be from imperfect condition. It has four narrow bands on the abdomen, and one a little wider at base." (Edwards's unpublished notes.)

Habitat: United States (Walker).

Ægeria lupini *Hy. Edwards.*

Ægeria lupini Hy. Edwards, Papilio, Vol. I, 1881, p. 192.
Ægeria madariæ Hy. Edwards, Papilio, Vol. I, 1882, p. 201.

I am unable to find any differences whatever between the types of *Ægeria lupini* and *Ægeria madariæ* to warrant their separation as distinct species.

Types: *Æ. lupini*, three males and three females from California; *Æ. madariæ*, one male and one female from California. Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Ægeria pictipes *G. & R.*

Ægeria pictipes GROTE & ROBINSON, Trans. Am. Ent. Soc. Vol. II, 1868, p. 182; BAILEY, N. Am. Ent. Vol. I, 1879, p. 17, pl. iii.
Ægeria inusitata HY. EDWARDS, Papilio, Vol. I, 1881, p. 201.

The type of *Æ. inusitata*, which is before me, is nothing more than a worn and faded example of *Æ. pictipes.*

Types: *Æ. inusitata*, one male from Andover, Mass.; *Æ. pictipes*, three specimens from New York. Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Ægeria lustrans (*Grote*).

Trochilium lustrans GROTE, Can. Ent. Vol. XII, 1880, p. 213.
Ægeria sexfasciata HY. EDWARDS, Papilio, Vol. I, 1881, p. 193.
Ægeria consimilis HY. EDWARDS, Papilio, Vol. I, 1881, p. 194.
Ægeria eupatori HY. EDWARDS, Papilio, Vol. I, 1881, p. 195.
Ægeria infirma HY. EDWARDS, Papilio, Vol. I, 1881, p. 195.

There are no differences between the types of *Æ. sexfasciata*, *Æ. consimilis*, and *Æ. eupatori*, which will separate these from the large series of *Æ. lustrans*, including the type which I have before me, nor are there any varital differences. *Æ. infirma* is also the same.

Types: *Æ. sexfasciata*, one male, Texas; *Æ. consimilis*, one male, Dorchester, Mass.; *Æ. eupatori*, one male, New York; *Æ. lustrans*, four males and seven females, New York, West Virginia, Ohio, Kansas, and Texas. Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Pyrrhotænia coloradensis, sp. nov.

Primaries reddish-orange, with the costa narrowly margined with fuscous, which is also the color of the median vein, the cilia and the rather large spot at the end of the discal area. Secondaries reddish-orange, with the cilia and discal spot fuscous. Wings beneath, same color as above. Head, thorax and legs black. The thorax has a few silvery-white hairs on the posterior portion (the scales on the anterior portion are abraded). Body black, with a silvery-white scale-like band on the posterior end of each segment. Caudal tuft black. Underside of body wholly sooty black. Expanse, 22 mm.

One female, Custer County, Colorado (Cockerell), Sept. Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Pyrrhotænia texana *Hy. Edwards.*

Pyrrhotænia texana Hy. Edwards, Papilio. Vol. I, 1881, p. 204.
Pyrrhotænia wittfeldii Hy. Edwards, Papilio, Vol. III, 1883, p. 156.

I am unable to find any differences whatever that will separate *P. wittfeldii* from *P. texana.* The latter name has precedence, and was described from Texas.

Types: *P. wittfeldii*, two males, Indian River, Florida; *P. texana*, two authentic males, Indian River, Florida. Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Pyrrhotænia behrensii *Hy. Edwards.*

Pyrrhotænia behrensii Hy. Edwards, Papilio, Vol. II, 1882, p. 123.
Pyrrhotænia elda Hy. Edwards, Ent. Am. Vol. I, 1885, p. 49.

Mr. Edwards's unpublished note on these species is as follows: "*P. elda* is the female of *P. behrensii.*"

Types: *P. behrensii*, three males; *P. elda*, two females, Soda Springs, Siskiyou County, California.

Pyrrhotænia fragariæ *Hy. Edwards.*

Pyrrhotænia fragariæ Hy. Edwards, Papilio, Vol. I, 1881, p. 202.
Pyrrhotænia helianthi Hy. Edwards, Papilio, Vol. I, 1881, p. 203.

A single type female, labeled *P. helianthi*, from Soda Springs, California, in the Edwards Collection, is the same as *P. behrensii.* Mr. Edwards certainly made a mistake in so labeling this specimen. *P. helianthi* was described by him from a single male and female from Virginia City, Nevada; it is therefore hardly possible that the specimen is one of the types; moreover, Mr. Edwards's unpublished note says: "*P. helianthi* is the female of *P. fragariæ.*"

Article III.—LIST OF MAMMALS AND BIRDS COLLECTED IN NORTHEASTERN SONORA AND NORTHWESTERN CHIHUAHUA, MEXICO, ON THE LUMHOLTZ ARCHÆOLOGICAL EXPEDITION, 1890–92.

By J. A. Allen.

The expedition of Dr. Carl Lumholtz, under the auspices of the American Museum of Natural History, was primarily undertaken for research in the line of archæology. During the first two years of its work, however, some attention was given to general natural history, collections being made in zoölogy and botany. While only about fifty-five mammals were collected, they possess considerable interest. About one thousand birds were obtained, representing one hundred and sixty-two species. Unfortunately, however, most of the ornithological work appears to have been done during fall and winter, and thus the results are less satisfactory than would have been the case had collecting been more actively carried on during summer. The bulk of the collection consists of North American species, but the record of localities given below often affords definite information of much interest respecting their winter distribution.

The expedition set out from Bisbee, in southeastern Arizona, early in September, 1890, proceeding southward about two hundred and twenty-five miles to Bacadehuachy and Nacory, on the Rio Yaqui, passing the following places in the order named: San Pedro (32 miles south of Bisbee), Los Trincheras, Santa Barbara, Fronteras, Cachuta (102 miles south of Bisbee), Los Trinitas (129 miles south of Bisbee), Los Pinitos, Los Cuevas (alt. 1750–2300 feet), Oputo, Granados, Bacadehuachy (the last three on the Rio Yaqui). Thence turning eastward toward and across the Sierra Madre the following were passed: Nacory (alt. 3400 feet), Heurachi (alt. 4000 feet), Napolera, El Puerto (alt. 6300 feet), Bavispee River (on its extreme upper course), Rancheria de los Apaches (alt. 6620 feet), Chuhuachupa, Tachico (alt. 2000 feet), to San Diego (alt. 4000 feet) on the eastern slope. San Diego was for some time (Feb. 16 to May 6) the base of operations, from which trips were made to Guanopa, Rio Chico and Tatuara (Feb. 15–March 1).

The specimens of birds and mammals were collected principally by Mr. F. Robinette, of Washington, D. C. A few were collected by Mr. A. D. Meeds, of Minneapolis, Minn. Unfortunately no notes accompany the specimens, beyond the locality and date of collecting, and many of the localities are not on published maps.

MAMMALS.

1. **Lepus alleni** *Mearns.*—Two specimens, Oputo, Oct. 27.

2. **Lepus arizonæ** *Allen.*—One specimen, San Diego, northern Chihuahua, Nov. 5.

3. **Thomomys umbrinus** (*? Rich.*).—Seven specimens, Juarez, northern Sonora. Referred provisionally to this species, and doubtless the same as *T. umbrinus* of Baird, based in part on Sonoran specimens.

4. **Perodipus** sp.?—One specimen, imperfect, and without label.

5. **Mus musculus** *Linn.*—Three specimens, Juarez, northern Sonora.

6. **Neotoma mexicana** *Baird.*—One specimen, Cachuta, northern Sonora, Oct. 3.

7. **Sigmodon hispidus arizonæ** *Mearns.*—One specimen, Granados, Nov. 16.

8. **Onychomys** sp.?—One specimen (in poor condition), Jaurez, northern Sonora.

9. **Cynomys arizonensis** *Mearns.*—Three skins, San Diego, Chihuahua, Nov. 14, 1891, A. D. Meeds.

10. **Sciurus aberti** *Woodh.*—One skin, in the gray phase, and an additional skull and skeleton. Without labels, but probably taken in December, on the upper Bavispee River.

11. Sciurus apache, sp. nov.

Upper premolars $\frac{1}{1}$. Size large; tail long, full and bushy, the vertebræ alone nearly equal to head and body. Above pale yellowish gray, varied with black, darkest on the head; dorsal pelage at base pale plumbeous, the coarser hairs pale buff, with a broad subterminal ring of black and a whitish tip; below uniform pale orange yellow, as are also the limbs and feet; tail above black, broadly fringed with yellowish white, below with a broad central band of dull ferrugineous orange, bordered on either side with a broad band of black, and a broad fringe of yellowish white, the basal half of the hairs being dull orange, the next fourth black, and the apical fourth yellowish white. A pale yellow eye-ring. Ears moderate, rounded, yellowish, mixed with gray, both externally and within.

Measurements.—(Approximate, from skin.) Head and body, 320 mm.; tail vertebræ, 265; tail to end of hairs, 360; hind foot, 72; ear, from crown, 20.

Skull.—Rostral portion short and broad, the nasals but little narrowed posteriorly. Total length, 64; basilar length, 58; greatest breadth, 36; least interorbital breadth, 22; length of nasals, 20; width of nasals at posterior border, 12.

Type, No. $\frac{5370}{4302}$, Northern Chihuahua, Lumholtz Expedition.

This species is based on two skins and skull taken in Northern Chihuahua by the Lumholtz Expedition, probably in November or December, the specimens being evidently in late fall or winter pelage. They were unfortunately without labels when received.

The skull presents a general resemblance in size and form to skulls of other species of the subgenus *Parasciurus*, or the group with the premolars $\frac{1}{1}$. It appears to most resemble the skull of *S. arizonensis* Coues, but has the rostral portion shorter and broader than in average specimens of this species. The skull differs in a similar way from that of *S. nayaritensis* Allen.

In coloration *S. apache*, as the above description shows, presents no suggestion of close affinity with either *S. arizonensis* or *S. nayaritensis*, but strongly recalls that of pale examples *S. niger ludovicianus;* and it is undoubtedly related to the *S. niger* group. At first it seemed probable that the specimens above described would prove referable to *Sciurus limitis* Baird, based on a specimen from "Devil's River, or the San Pedro of the Rio Grande, Texas," but reference to Baird's description of *S. limitis* shows the latter to be very different from the form here described as *S. apache*.

NOTE ON **Sciurus arizonensis** COUES.—A large series of skulls of this species, recently presented to the American Museum of Natural History by Dr. Edgar A. Mearns, by whom they were collected at various localities in Arizona, shows that this species belongs to the *Parasciurus* group, the upper premolars being $\frac{1}{1}$ instead of $\frac{2}{1}$, as formerly supposed. When treating of this species in 1877,[1] no skulls were available for examination, and from its general resemblance in coloration to *Sciurus carolinensis* it was referred, erroneously as it now appears, to the same section of the genus. *Parasciurus* thus proves to have a nearly transcontinental range, instead of being an exclusively 'Eastern' genus, as recently assumed by the present writer.[2] It also has a wide range in Mexico, occurring in the Sierra Madre region southward into the States of Zacatecas and Vera Cruz, where it is represented respectively by *S. nayaritensis* Allen and *S. niger melanonotus* Thomas.

12. **Cariacus virginianus** (subsp.?).—Several imperfect flat skins, including two with skulls and feet, and two separate skulls of does. The skins include one that is pure white (albino). Bavispee River, October, 1890.

A full-grown male has antlers of the usual style of *C. virginianus*, but another specimen shows that old bucks sometimes develop antlers of large size, with very numerous tines, the left antler in this specimen having eight points and the right one six points; they are, however, unsymmetrical in the two antlers and represent an abnormal development. This head strongly suggests the remarkable growth of points seen in some specimens of *C. v. leucurus*. The length of the left antler measured along the convexity of the beam is sixteen and one-half inches; the length of the principal tine is six inches.

In coloration these specimens closely resemble *C. v. leucurus*, but are rather lighter, with a whiter tail. They apparently represent a much larger form than Baird and some other authors have recognized under the name *Cariacus mexicanus*.

13. **Mephitis estor** *Merriam*.—Two specimens, San Diego, northern Chihuahua, Oct. 28.

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[1] Monographs of N. Am. Rodentia, pp. 738-741.

[2] This Bulletin, IV, p. 218.

These specimens agree with Dr. Merriam's description of his *M. estor* from San Francisco Mountain, Arizona, to which species they are here provisionally referred.

14. **Procyon lotor hernandezii** (*Wagler*).—Represented by a single skin without label.

15. **Urocyon virginianus scottii** *Mearns*.—Several skins, separate skulls, and a skeleton.

16. **Canis latrans** *Say*.—Two skins with skulls, from northwestern Chihuahua, in winter coat. These compared with specimens in summer pelage from Arizona (Mearns Coll.) show that the seasonal change in the coloration and texture of the pelage is very great. In winter specimens the coat is long, fine and soft, above yellowish gray varied with black; in summer examples it is thin, coarse and harsh, above yellowish brown, with very little mixture of black.

Specimens in winter coat from Montana are very different in coloration from those from northern Mexico taken at the same season, the southern specimens being much more yellowish throughout, with the posterior surface of the ears, occiput, and the outer surface of the limbs golden brown, much brighter and more golden than in the northern specimens. Doubtless a proper amount of material for comparison would demonstrate the desirability of recognizing several subspecies among the Coyotes, which range from Central America northward to beyond the northern boundary of the United States.

17. Lynx rufus maculatus (*Horsf. & Vig.*).

Felis maculata HORSF. & VIG. Zool. Journ. IV, 1829, p. 381, pl. xiii. (Mexico.)
Lynx rufus var. *maculatus* BAIRD, Mam. N. Am. 1857, p. 93.
? *Lynx baileyi* MERRIAM, N. Am. Fauna, No. 3, 1890, p. 79. (Southern Arizona.)

Two specimens, in winter pelage, without labels, but probably from Camp 21, on the Bavispee River, 15 miles from Chuchuichupa, December, 1891. One is adult, the other about half grown. The adult specimen agrees very well with the description of *Felis maculata* Horsfield & Vigors, to which these specimens are provisionally referred. Whether or not it is the same as *Lynx baileyi*

Merriam, from Arizona, is not easy to determine, since Dr. Merriam's comparisons are exclusively with specimens of *L. rufus* from Connecticut.

A series of 15 specimens from Arizona (Mearns Collection) presents a wide range of variation in color, summer specimens being more tawny than winter specimens, with the black spots of the lower parts more vividly contrasted. with the purer white ground color. There is also much individual variation, especially in respect to the distinctness of the face and head markings.

Two specimens from Florida (Tarpon Springs) are, as compared with northern *rufus*, very dark in general coloration, especially over the hinder portion of the dorsal surface, and the head markings are stronger. These represent a fairly recognizable Florida form, provisionally termed "*Lynx rufus* var. *floridanus* Rafinesque" by Baird in 1857 (l. c., p. 91, in text). A single specimen from Brownsville, Texas, is strikingly similar in general coloration. Two specimens from the formerly so-called 'Neutral Strip,' Indian Territory, are much more like the northern *L. rufus*. Two winter specimens from Montana have, in comparison with all of the other specimens, a much longer, thicker, softer pelage, as would be expected from the season and locality, but they are also grayer and less strongly spotted.

Doubtless the Lynxes of the widely distributed *L. rufus* group will be found separable into a number of more or less well-marked geographical forms, when sufficient material for comparison is brought together.

BIRDS.[1]

1. **Mergus americanus.**—Two specimens (labels lost).

2. **Anas strepera.**—San Diego, Feb. 2.

3. **Anas americana.**—Cachuta, Oct. 2.

4. **Anas carolinensis.**—Nacory, Nov. 30; San Diego, Feb. 2.

5. **Anas discors.**—Cachuta, Oct. 2.

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[1] As nearly all of the species here mentioned occur in the American Ornithologists' Union 'Check-List of North American Birds,' authorities for the scientific names are omitted, except where the species is extralimital to the A. O. U. Check-List.

6. **Anas cyanopterus.**—San Diego, Nov. 10.

7. **Dafila acuta.**—Cachuta, Oct. 3.

8. **Spatula clypeata.**—San Diego, March 14.

9. **Erismatura rubida.**—Pachico, June 22.

10. **Plegadis guarauna.**—Cachuta, Oct. 5.

11. **Ardea herodias.**—San Diego, Feb. 19.

12. **Ardea candidissima.**—Three specimens (labels lost).

13. **Fulica americana.**—Pachico, June 22; Cachuta, Sept. 28–30.

14. **Recurvirostra americana.**—Oputo, Oct. 22.

15. **Himantopus mexicanus.**—Cachuta, Oct. 10.

16. **Gallinago delicata.**—Pachico, Jan. 25; Chuhuichupa, Jan. 2–14; San Diego, Oct. 23.

17. **Tringa bairdii.**—One specimen (without label).

18. **Tringa minutilla.**—San Pedro, Sept. 15; San Diego, April 1.

19. **Ereunetes occidentalis.**—Cachuta, Oct. 2.

20. **Totanus melanoleucus.**—One specimen (without label).

21. **Totanus solitarius.**—San Diego, April 13.

22. **Totanus solitarius cinnamomeus.**—Cachuta, Oct. 8.

23. **Ægialitis vocifera.**—Bisbee and Greenbush Ranch, Sept. 6–10; Pachico, June 22.

24. **Cyrtonyx montezumæ.**—Los Pinitos, Los Vengos, Nacory, and Huerachi, Oct. 12–Dec. 6.

25. **Callipepla gambeli.**—Santa Barbara, Sept. 21.

26. **Callipepla elegans** (*Less.*).—Nacory, Nov. 27.

27. **Callipepla squamata.**—San Pedro and Bisbee, Aug. 15–Sept. 26; San Diego, Feb. 16.

28. **Zenaidura macroura.**—Near Bisbee, August; Huerachi, Dec. 6.

29. **Melopelia leucoptera.**—Bisbee, July.

30. **Scardafella inca.**—Granados, Nov. 12–15.

31. **Cathartes aura.**—Fronteras, Sept. 23.

32. **Circus hudsonius.**—Rancheria de los Apaches, Jan. 10.

33. **Accipiter velox.**—Granados, Nov. 11; Pachico, June 22.

34. **Buteo borealis calurus.**—Chuhuichupa, Jan. 14.

35. **Buteo swainsoni.**—Fronteras, Sept. 23.

36. **Urubitinga anthracina.**—San Diego, March 31.

37. **Asturina plagiata.**—Fronteras, September; Oputo, Oct. 26.

38. **Falco columbarius.**—San Diego, Oct. 23.

39. **Falco sparverius deserticolus.**—Pachico, June 28 and Jan. 25; Granados, Sept. 27 and Nov. 11; Nacory, Nov. 29; Bavispee River, Dec. 30.

40. **Asio wilsonianus.**—San Diego, March 14.

41. **Bubo virginianus subarcticus.**—San Diego, Feb. 19–23.

42. **Speotyto cunicularia hypogæa.**—San Pedro, Sept. 15.

43. **Rhynchopsitta pachyrhyncha** (*Swains.*). — Three specimens, Pachico, June 20.

44. **Geococcyx californianus.**—Near Bisbee, August.

45. **Euptilotis neoxenus** (*Gould*).—One specimen, sexed as a male, but if so it is immature, taken at El Pinita, Dec. 16, 1890.

46. **Ceryle alcyon.**—San Diego, Feb. 24; Chuhuichupa, Jan. 14.

47. **Campephilus imperialis** (*Gould*).—Seven specimens, taken as follows: Chuhuichupa, Jan. 25–29, 1892; Bavispee River, Dec. 24, 1890; Rancheria de los Apaches, Jan. 10, 1891. Dr. Lumholtz informs me that the species is common at the localities last named.

48. **Dryobates villosus hyloscopus.**—El Puerto, Dec. 7; Rancheria de los Apaches, Jan. 14–25.

49. **Dryobates arizonæ.**—Rancheria de los Apaches, Jan. 14 and 15.

50. **Dryobates scalaris.**—Oputo and Bacadehuachy, Sept. 25–Nov. 29; San Diego, Feb. 24.

51. **Sphyrapicus varius nuchalis.**—El Pinita and Los Cuevos, Oct. 12–15; El Puerto, Dec. 16; Bavispee River, Dec. 30; Rancheria de los Apaches, Jan. 15. One of the El Puerto specimens (No. 56,498, ♂), shows an excessive tendency to erythrism, the usual red throat patch extending posteriorly over the whole breast, where the feathers are merely black at the base and red apically, the usual broad black breast patch being concealed by the broad red tips of the feathers. The posterior half of the superciliary and subocular white stripes is also strongly washed with red—a feature occasionally developed in specimens from other localities. The El Puerto specimen thus has very much the appearance of a small *S. ruber*.

52. **Sphyrapicus thyroideus.** — Female, Bavispee River, Dec. 12; male, Rancheria de los Apaches, Jan. 15. This last example (No. 56,494, ♂ ad.) also shows an abnormal development of red on the breast, the usual red gular stripe broadening posteriorly and continuing over the breast, where it occupies the middle third of the pectoral area. The feathers of the whole top of the head are also broadly tipped with bright red. It thus at first sight, through the red crown and extension of the red throat spot over the breast, has the appearance of being a very different species from *S. thyroideus*. In the absence of other specimens, however, it seems best to treat it as merely an abnormal example of *S. thyroideus*.

53. **Melanerpes formicivorus bairdi.**—Cachuta and El Pinita, Oct. 9–14; Pachica, June 22; San Diego, Oct. 30.

54. **Melanerpes uropygialis.** — Fronteras, Sept. 20–27; Bacadehuachy, Nov. 20.

55. **Colaptes cafer.**—Los Trincheras, Sept. 20; El Pinita, Oct. 12; Rancheria de los Apaches, Jan. 10; San Diego, Nov. 5.

56. **Phalænoptilus nuttalli nitidus.**—San Diego, Nov. 12.

57. **Chordeiles acutipennis texensis.**—San Diego, April 21–24.

58. **Aëronautes melanoleucus.**—Granados, Nov. 16.

59. **Trochilus alexandri.**—Bisbee, Arizona, July and August.

60. **Calypte costæ.**—El Pinita, Oct. 14.

61. **Selasphorus alleni.**—Bisbee, August and September; Santa Barbara, Sept. 21.

62. **Tyrannus vociferans.**—Leoncita and Fronteras, Sept. 21–27.

63. **Tyrannus verticalis.**—San Diego, April 13–21.

64. **Myiarchus cinerascens.**—San Diego, April 21–23.

65. **Myiarchus inquietus** (*Salv. & Godm.*).—Oputa, Sept. 9; Bacadehuachy, Dec. 20.

The two specimens above recorded seem unquestionably referable to Mr. Salvin's recently described *Myiarchus inquietus*,[1] from the State of Guerrero, Mexico, although from localities so much further north. We have, however, a specimen from Zapotlan, Jalisco (collected by Dr. A. C. Butler), a much more southern but still an intermediate point. Doubtless it will prove to range throughout the mountainous parts of Mexico, as *Myiarchus cinerascens nuttingi* has recently been found to do.

66. **Sayornis phœbe.**—San Diego, Feb. 24.

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[1] Biolog. Cent. Am. Aves, II, p. 88, March, 1892.

67. **Sayornis saya.**—San Pedro, Sept. 9; San Diego, April 5.

68. **Sayornis nigricans.**—San Diego, May 15 and Nov. 5; Granados, September and November.

69. **Contopus richardsoni.**—San Diego.

70. **Empidonax difficilis.**—Los Cuevos, Oct. 15.

71. **Empidonax wrightii.**—Oputo, Nov. 9–25; San Diego, April 3–22.

72. **Empidonax hammondi.**—Los Cuervos, Oct. 15.

73. **Pyrocephalus rubineus mexicanus.**—San Pedro, Sept. 15; Granados and Nacory, November; San Diego, March 10 and April 15; Pachico, June 22.

74. **Otocoris alpestris adusta.**—San Diego, Feb. 16 and Nov. 5.

75. **Cyanocitta stelleri macrolopha.**—El Pinita, Oct. 12; also four specimens without labels.

76. **Aphelocoma woodhousei.**—Bisbee, July 14.

77. **Aphelocoma sieberi arizonæ.**—Cachuta, Oct. 9; Bavispee River, Dec. 16; San Diego, April 8.

78. **Corvus corax sinuatus.**—Chuhuichupa, Jan. 14.

79. **Corvus cryptoleucus.**—San Pedro, Sept. 16.

80. **Molothrus ater obscurus.**—Bisbee, July 30.

81. **Xanthocephalus xanthocephalus.**—Pachico, June 22; San Pedro, Sept. 12.

82. **Agelaius phœniceus sonoriensis.**—Nacory, Nov. 26; San Diego, March 13; Pachico, June 22.

83. **Sturnella magna mexicana.**—San Diego, Oct. 20 and Feb. 26; San Pedro and Cachuta, Sept. 15–30; Nacory, Nov. 24.

84. **Icterus parisorum.**—Bisbee, July 21.

85. **Icterus cucullatus nelsoni.**—Bisbee, July 17.

86. **Scolecophagus cyanocephalus.**—San Pedro and Cachuta, Sept. 15–30.

87. **Carpodacus mexicanus frontalis.**—Oputo, Oct. 25–27; Granados and Nacory, November.

88. **Spinus psaltria.**—Los Cuevos, Oct. 15.

89. **Spinus pinus.**—San Diego, March and April; Rio Chico, Feb. 9.

90. **Calcarius ornatus.**—San Diego, Feb. 18–24.

91. **Rhynchophanes mccowni.**—San Diego, Feb. 16.

92. **Poocætes gramineus confinis.**—San Diego, Feb. 16–18.

93. **Ammodramus sandwichensis alaudinus.**—San Diego, Feb. 18.

94. **Ammodramus bairdi.**—Nuevencha Plain, Feb. 15.

95. **Chondestes grammacus strigatus.**—Bisbee, Aug. 12–14; Nacory, Nov. 27.

96. **Zonotrichia leucophrys intermedia.**—Fronteras, Sept. 27; Oputo, Oct. 30; Granados, Nov. 15; San Diego, Oct. 30 and April 3–13.

97. **Spizella socialis arizonæ.** — Puerto de los Pinitos, Bacadehuachy, and Nacory, Nov. 13–24; San Diego, April and October.

98. **Spizella pallida.**—Oputo, Oct. 27; San Diego, Feb. 18 and April 13.

99. **Spizella breweri.**—Granados, Nov. 15.

100. **Junco hyemalis shufeldti.**—Chuhuichupa, Jan. 11.

101. **Junco annectens.**—Rancheria de los Apaches, Jan. 10–17.

102. **Junco caniceps.**—Napolera, Dec. 12; Bavispee River, Dec. 22; Rancheria de los Apaches, Jan. 10; Chuhuichupa, Jan. 11.

103. **Junco cinereus palliatus.**—Chuhuichupa, Jan. 19.

104. **Junco cinereus dorsalis.**—San Diego, Nov. 11.

105. **Amphispiza bilineata.**—Bisbee, July 9–Sept. 9; Oputo, Oct. 30.

106. **Aimophila superciliosa** (*Swain.*).—Bavispee River, Dec. 21–26; Pachico, Jan. 27.

107. **Aimophila mcleodi** (*Brewster*) —Puerto de los Pinitos, Oct. 14.

108. **Peucæa ruficeps boucardi.**—Bisbee, July 10; Bavispee River, Dec. 26.

109. **Peucæa notosticta** (*Scl. & Salv.*).—Bavispee River, Dec. 26; Guanopa, Feb. 2.

110. **Peucæa carpalis.**—Granados, Nov. 16.

111. **Peucæa cassini.**—Cochise Co., Arizona, Aug. 24–Sept. 4.

112. **Melospiza fasciata montana.**—Bavispee River, Dec. 12–26.

113. **Melospiza fasciata mexicana.**—Bavispee River, Dec. 21–26.

114. **Melospiza lincolni.**—Fronteras, Sept. 27; Nacory, Nov. 27; Napolera, Dec. 9–10; Bavispee River, Dec. 26.

115. **Pipilo maculatus megalonyx.**—Los Pinitos, Oct. 9–13.

116. **Pipilo chlorurus.**—Fronteras, Sept. 26, 27; Bacadelhuachy, Nov. 21.

117. **Pipilo fuscus mesoleucus.**—Granados, Nov. 12; Nacory, Nov. 24; San Diego, Oct. 27; Neuvencha Plain, Feb. 14.

118. **Cardinalis cardinalis superbus.**—Oputo, Oct. 27.

119. **Pyrrhuloxia sinuata beckhami.**—Granados, Nov. 14.

120. **Calamospiza melanocorys.**—Oputo, Oct. 27–30.

121. **Piranga rubra cooperi.** — Fronteras, Aug. 25; San Diego, April 21–May 6.

122. **Piranga hepatica.**—El Pinita, Oct. 12–14.

123. **Tachycineta bicolor.**—San Diego, Feb. 24–26.

124. **Tachycineta thalassina.**—Bisbee, July 7; San Pedro, Aug. 12; San Diego, Feb. 26.

125. **Phainopepla nitens.**—Oputo, Sept. 15–27; Nacory, Nov. 26.

126. **Lanius ludovicianus excubitoroides.** — Cachuta, Sept. 2; San Pedro, Sept. 15; San Diego, Feb. 16.

127. **Vireo solitarius cassini.**—Cachuta, Sept. 2.

128. **Vireo solitarius plumbeus.**—San Diego, April 28; Pachico, June 22.

129. **Vireo huttoni stephensi.**—Bacadehuachy, Nov. 20.

130. **Helminthophila luciæ.**—Bisbee, July 30.

131. **Dendroica æstiva sonorana.**—Bisbee, Aug. 13; San Diego, March 3, April 1 and 13.

132. **Dendroica auduboni.**—Los Cuevas, Sept. 3; Oputo, Sept. 15–27; San Diego, March 13 and April 15.

133. **Dendroica nigrescens.**—San Diego, April 21.

134. **Geothlypis trichas melanops** (*Baird*).—San Diego, May 6.

135. **Icteria virens longicauda.**—San Diego, May 6; Lansito, Aug. 9.

136. **Sylvania pusilla pileolata.**—San Diego, April 15–21.

137. **Setophaga picta.**—Guanopa, Feb. 2; Huerachi, Dec. 6.

138. **Basileuterus rufifrons** (*Swain.*).—Napolera, Dec. 8.

139. **Cinclus mexicanus.**—Chuhuichupa, Jan. 22.

140. **Mimus polyglottos.**—Oputo, Sept. 23; northern Chihuahua (without labels), mostly young birds in spotted plumage.

141. **Harporhynchus curvirostris.**—Oputo, Sept. 23 and Nov. 9; Nacory, Nov. 24.

142. **Campylorhynchus brunneicapillus.**—Oputo, Sept. 21.

143. **Salpinctes obsoletus.**—Fronteras, Sept. 27; Bavispee River, Dec. 12.

144. **Catherpes mexicanus.**—Pachica, Feb. 3.

145. **Thryothorus bewickii bairdi.**—Chihuahua, Jan. 15 and March 10; San Diego, April 3.

146. **Troglodytes aëdon aztecus.**—Bavispee River, Dec. 22; San Diego, April 15; El Puerto, Dec. 16.

147. **Certhia familiaris mexicana.**—Napolera, Dec. 12; Chuchuichupa, Jan. 22.

148. **Sitta pygmæa.**—Bavispee River, Jan. 15; Totuaco, Feb. 29.

149. **Sitta carolinensis aculeata.**—El Pinita, Sept. 10; Napolera, Nov. 17; Bavispee River, Dec. 22–30.

150. **Parus wollweberi.**—Puerto de los Pinitos, Sept. 14; Napolera, Dec. 12.

151. **Parus meridionalis.**—Chihuahua, Jan. 14, 15; Tatuaca, Feb. 13–29.

152. **Psaltriparus lloydi.**—Bavispee River, Dec. 28.

153. **Auriparus flaviceps.** — Granados, Nov. 13; Bacadehuachy, Nov. 20.

154. **Regulus calendula.**—Los Cuevas, Sept. 15; Bacadehuachy, Nov. 11; Nacory, Nov. 24; Napolera, Dec. 10; Guanopa, Feb. 3; Tatuaca, Feb. 29.

155. **Polioptila plumbea.**—Oputo, Sept. 10–23.

156. **Polioptila cærulea obscura.**—Oputo, Sept. 10; Bacadehuachy, Nov. 20.

157. **Turdus aonalaschkæ.**—Bacadehuachy, Nov. 11.

158. **Turdus aonalaschkæ auduboni.**—Rio Chico, Feb. 8; Bavispee River, Jan. 1.

159. **Merula migratoria propinqua.**—San Diego, March 15.

160. **Sialia sialis.**—Bavispee River, Dec. 30; Red Bank, Feb. 27.

161. **Sialia mexicana.**—Nacory, Nov. 24.

162. **Sialia arctica.**—Nacory, Nov. 24; Pachico, Jan. 5.

The foregoing list of birds shows that the following Mexican species occur, probably as resident birds, within about 150 miles of the southern border of the United States.

Callipepla elegans.
Rhynchopsitta pachyrhyncha.
Euptilotis neoxenus.
Campephilus imperialis.
Myiarchus inquietus.
Aimophila supercilosa.
Aimophila meleodi.
Peucæa notosticta.
Geothlypis trichas melanops.
Basileuterus rufifrons.

Article IV.—DESCRIPTION OF A NEW SUBSPECIES OF ORYZOMYS FROM THE GULF STATES.

By Frank M. Chapman.

The type of the genus *Oryzomys* was discovered by Bachman in 1816 in the marshes of South Carolina. Twenty years later he sent a specimen with a description to Drs. Pickering and Harlan of the Academy of Natural Sciences at Philadelphia. Bachman named this new rodent *Arvicola oryzivora*, and requested that a comparison be made between his specimen and the *Arvicola riparia* of Ord, with which he was not familiar. The comparison was made by Dr. Harlan, who incidentally found a specimen of Bachman's new species in the Academy collection. This specimen was labeled as being taken near Fastland, near Salem, New Jersey, and Dr. Harlan, who was apparently unable to withstand the temptation of affixing his name to a new species, pigeon-holed Bachman's manuscript and himself described the New Jersey specimen under the name *Mus palustris.*[1]

Dr. Harlan said of the habitat of this species: "Found in the fresh-water swamps of New Jersey and South Carolina. The present specimen was taken near Fastland, in the vicinity of Salem." And adds: "A similar specimen was sent me by Dr. Bachman, of Charleston, S. C.;" this being the only credit Bachman received for his discovery.

In commenting on this obviously unfair treatment, Bachman states[2] that Dr. Harlan made use of the head of the South Carolina specimen for an examination of the teeth. Harlan, however, makes no mention of Bachman's specimen beyond the brief remark just quoted, and the type locality of *Oryzomys palustris* is therefore New Jersey. It is true that the type is the only specimen known to have been taken in the State, but in view of the recent discovery by Messrs. Rhoads and Stone of *Synaptomys* and *Evotomys* in Southern New Jersey, we may conclude that our knowledge of the mammalogy of the region may receive still further additions.

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[1] Am. Journ. Sci. and Arts, XXXI, 1837, p. 385.

[2] Quad. N. Am., III, 1853, p. 216.

Several years ago I collected eight specimens of *Oryzomys* in Florida, and since then the Museum has received six apparently similar specimens from New Orleans (Gustav Kohn), one from Wharton County, Texas (Geo. B. Sennett), and one from Rockport, Texas (H. P. Attwater). Later the Museum received six specimens from Raleigh, N. C. (Brimley), and one from Frogmore, S. C. (Hoxie). Comparison of the Gulf States specimens with those from the Carolinas show that they belong to two well-marked races.

It is of course impossibe to say whether the Carolina specimens would agree with an as yet uncollected series from southern New Jersey, but until such a series is forthcoming the name *palustris* is evidently applicable to the northern form, from which I propose to separate the Gulf States race under the name

Oryzomys palustris natator, subsp. nov.

Char. Subsp. (Type, No. $\frac{1818}{1089}$, ♂, Am. Mus. Nat. Hist., collected by F. M. Chapman at Gainesville, Florida, Jan. 31, 1889).—Larger than North Carolina specimens, the pelage averaging heavier and always much darker. In Raleigh specimens the general color of the dorsal surface is not unlike that of *Mus decumanus;* in adults of the new race the dorsal surface more nearly resembles that of *Fiber zibethicus* in color, though it is by no means so dark as in that animal. The difference in size illustrates the law of increase in size toward the centre of distribution, and is shown by the following measurements taken in the flesh:

	Length.	*Tail.*	*Hind Foot.*
Five males from Raleigh, N. C.	2.37	1.20	30 mm.
Five males from Gainesville, Florida. .	2.86	1.36	33 mm.

There are apparently no diagnostic cranial characters.

REMARKS.—There are two interesting points developed by the range of this new form. First, it is somewhat unexpected to find Texas specimens resembling those from Florida. For example, the Seaside Finches of Florida (*Ammodramus nigrescens* and *A. maritimus peninsulæ*) are the darkest of the genus, while the race from Texas (*A. m. sennetti*) is the palest. Still *Oryzomys* inhabits the same marshes in which these Finches abound, and is apparently subjected to the same environmental influences. I say *apparently*, for a field experience in both Florida and Texas marshes gives me reason to believe that while these localities are separated by a thousand miles, and are included in different faunæ, in the case of these Rats at least, the character of their haunts in Florida is in effect so like that in Texas that no real difference exists in their immediate surroundings. The Finches before mentioned, which show in their respective plumages the effects of climates characterized respectively by heavy and comparatively light rainfall, are diurnal inhabitants of the air, where they are exposed to the full force of climatic influences. The Rats, on the contrary, are nocturnal, and almost subterranean. That is, their runways are made beneath the dense mat of grasses which cover the marshes bordering the gulf. In these half-flooded situations there can be little difference in the humidity of their habitats ; existing thus, under similar conditions, they exhibit similar phases of coloration.

To illustrate further the effect of environment I may instance a series of *Sigmodon* collected by myself at Corpus Christi, Texas, the same locality in which *Oryzomys* was observed. *Sigmodon* is very abundant there, inhabiting in large numbers both the dry, scrubby chapparal and swampy marshes. In the former case its runways were easily observable as well-worn paths ; in the latter they led beneath the dense mat of marsh grass, indeed were the same as those used by *Oryzomys*. Series of *Sigmodon* were collected in both the chapparal and marsh, each specimen being labeled with its exact locality. On comparison these series are easily distinguishable from each other, the specimens from the marsh being darker, and thus showing the result of their more humid home and protection from the sun's rays afforded by their covered run ways.

Both this instance and the preceding show the importance of field-study.

The second point of interest in the range of *O. p. natator* is the near approach of its habitat to that of the very distinct *Oryzomys aquaticus* Allen.

Although I have but one specimen from the known southern limit of the range of *natator* (Rockport, Texas), I have examined several specimens caught at Corpus Christi, but which unfortunately were too decayed to preserve. They showed, however, no approach to *Oryzomys aquaticus*. This species is known only from

Brownsville, Texas, little more than one hundred miles south of Corpus Christi. It is apparently specifically distinct from *natator*, but as the probable gateway by which the genus gained entrance to the United States it will be exceedingly interesting to learn whether the United States form has become specifically distinct from its Mexican ancestors, whether it intergrades with *aquaticus* at some point between Corpus Christi and Brownsville, or whether it occurs in the same region with *aquaticus*. In the latter case their specific distinctness would of course be proven.

Article V.—DESCRIPTIONS OF FOUR NEW SPECIES OF THOMOMYS, WITH REMARKS ON OTHER SPECIES OF THE GENUS.

By J. A. ALLEN.

In working up a collection of mammals from the San Juan region of Colorado, New Mexico and Utah (see next paper), two apparently very distinct new species of *Thomomys* were recognized. In attempting to define their status and relationships it became necessary to take into account the previously described species, which further involved the consideration of many vexed questions of synonymy. From this investigation has resulted the present paper, which consists essentially of four parts : I, Descriptions of New Species ; II, Discussion of various questions of Nomenclature ; III, Remarks on Cranial Characters in the genus *Thomomys ;* IV, List of Species and Subspecies.

In this connection I wish to express my hearty acknowledgments for the invaluable assistance kindly rendered me by various institutions and persons, through the loan of types and other material to facilitate my investigation. To the authorities of the Academy of Natural Sciences of Philadelphia, through the kind intervention of Mr. Witmer Stone, Curator of Birds and Mammals, for the loan of the historic Townsend specimens which served as the basis of Dr. Bachman's descriptions of his *Geomys borealis* and *G. townsendii.* To Mr. F. W. True, Curator of Mammals at the United States National Museum, for the type of Prof. Baird's *Thomomys laticeps*, and for many of the specimens on which Baird based his revision of the genus in 1857, and which later formed part of the material used by Dr. Coues in his monograph of the genus, including the type of his *Thomomys clusius*—in other words, for authentic specimens of the various forms recognized by these two authors. To Dr. C. Hart Merriam, Chief of the Division of Ornithology and Mammalogy, United States Department of Agriculture, for specimens identified by him as *T. clusius*, and for authentic specimens of his *T. clusius fuscus.* To Prof. C. H.

Gilbert, of the Leland Stanford Junior University, of California, for the series of specimens described below as a new species, under the name *Thomomy monticolus*. And finally to Mr. Gerrit S. Miller, Jr., of Cambridge, Mass., for specimens of Richardson's "*Diplostoma ? bulbivorum*," from the type locality of the species, and for permission to publish as inedited matter extracts from an unpublished paper of his on this important discovery.

I.—DESCRIPTIONS OF NEW SPECIES.

Thomomys monticolus, sp. nov.

Size medium. Skull long and narrow. A strong ridge on the inner edge of the outer face of the upper incisors. Claws long and rather slender. Ears prominent. Pelage very long and soft. Above dull pale reddish brown, strongly tinged with gray; below ashy white, sometimes with a faint tinge of buff; feet and tail whitish; mouth parts and entrance to pouches blackish; no white throat spot; ears in a large blackish area, of more than the usual extent.

Measurements.—Total length (from skin), 210 mm.; tail, 55; hind foot, 28; fore foot, 20; middle fore claw (arc), 14.

Skull.—The skull (Pl. I, Figs. 3 and 4) is narrow and elongated, the anteorbital portion especially narrow and slender. Interparietal bone very broad, about half the width of the skull, rounded in front, twice as broad as long. The nasals terminate a little in front of the fronto-intermaxillary suture. Upper incisors with a strong ridge on the inner margin of the outer face.

Total length of skull, 37 mm.; basilar length, 34; greatest breadth, 22; least interorbital breadth, 6; length of nasals, 14; width of nasals at posterior border, 2; length of interparietal bone, 4; its greatest width, 11.

Type, ♂ ad., No. 59, Mus. Leland Stanford Junior University, W. W. Price, coll., Mt. Tallac, El Dorado Co., Cal., Aug. 8, 1892 (altitude, 7500 feet).

This species most resembles in coloration specimens of *T. douglasii* from Ducks, B. C., but is grayer and of a dull pale chestnut instead of yellowish brown above, and purer gray below. The claws are longer and much weaker. The size and form of the interparietal bone is somewhat similar in the two, as are the general form and proportions of the skull. The sulcus at the inner border of the upper incisors is rather more developed, being readily distinguishable without the use of a lens. It is, however, apparently a much larger animal.

T. monticolus differs from Nicasio (Cal.) specimens of *Thomomys bottæ* (=*bulbivorus* Baird, *nec* Richardson—see beyond, pp. 56–58) very markedly in the color and texture of the pelage throughout, lacking entirely the yellowish cast in that species, both above and below. The claws are longer and more curved. It also differs from the Nicasio species in the general form and proportions of the skull, in the latter the skull being short and broad, especially the anteorbital portion, while in *T. monticolus* the whole skull is attenuated, and hence much narrower and longer, giving a slender, lengthened nose, instead of a short broad nose. In Nicasio specimens also the sulcus near the inner border of the incisors is usually obsolete and often wholly wanting. In Plate I are represented skulls of *T. monticolus*, *T. douglasii* and *T. bottæ*, showing the differences in the cranial characters above noted.

This species is based on four specimens, kindly loaned for identification and description by Prof. Charles H. Gilbert, of the Leland Stanford Junior University, at Palo Alto, California. Two are adult and two young, one of the latter being about half grown and the other apparently only a few weeks old. The half-grown one differs but little in color from the adults, being rather paler and grayer. The very young one is dull brownish gray above, passing into clear grayish white below.

Respecting these specimens the collector, Mr. W. W Price, has kindly furnished me with the following memoranda :

"The specimens of *Thomomys* were taken on Mt. Tallac, at altitudes varying from 6500 feet to 9500 feet. The specimens were abundant in grassy glades and during the day were often seen throwing up earth about their burrows.

"The smallest specimen was taken in level meadow land at the base of Mt. Tallac at about 6500 feet. The largest specimen was taken on the slope of Tallac at about 7500 feet elevation. The other two skins were taken near the summit, at over 9000 feet altitude."

Thomomys aureus, sp. nov.

Size large. Claws strongly developed. Skull, as seen from above, much as in Nicasio (California) specimens of *T. bottæ*, but with many differences in details of structure. Coloration very different from that of any form hitherto described.

Post-breeding Pelage.—Fur short, thin and soft. Above uniform strong sandy yellow or golden with a few dusky-tipped hairs on the crown, and in some specimens along the back ; below entirely white to the base of the hairs ; muzzle blackish, the dusky tint extending on to the edge of the pouches, there passing into white. A small blackish area below and behind the ear ; upper surface of feet white ; basal half of tail yellowish, passing into whitish apically.

Breeding Pelage.—Above dull yellowish with a dusky shade due to the plumbeous base of the fur showing through the slight surface wash of yellowish buff ; below grayish white, due to the dusky plumbeous basal portion showing through the clear grayish white surface tint.

Measurements.—Average of 12 specimens, from collector's measurements taken in the flesh : Total length, 296 mm.; tail, 66 ; hind foot, 35.

Skull.—(Pl. I, Figs. 6 and 7.) Similar in size and general outlines to that of *T. bottæ*, but broader in proportion to its length, with the interorbital and rostral portions especially broadened, and the whole skull much more heavily ossified throughout. In respect to the size and form of the interparietal bone, and the posterior extension of the nasal bones, the two forms present much similarity. The auditory bullæ in *T. aureus* are larger and somewhat different in outline ; the crown surfaces of the teeth are broader in proportion to their length ; the position of both palatine and the infraorbital foramina are more posterior than in *T. bottæ ;* and there are minor but very appreciable differences in other parts. In general details the skull of *T. aureus* perhaps more closely approaches that of *T. perpallidus*, but the two are readily separable, aside from the great difference in size. No comparison is necessary with the skull of *T. fulvus*, as shown by a comparison of the figures in Plate I.

An average full-grown skull measures as follows : Total length, 41 mm.; basilar length, 37 ; greatest breadth, 24 ; least interorbital breadth, 6 ; length of nasals, 14.

Type, No. $\frac{5248}{4123}$, Am. Mus. Nat. Hist., Bluff City, Utah, May 12, 1892, Charles P. Rowley, collector.

Thomomys aureus needs no comparison with any of its allies. It is nearly twice the size of *T. fulvus*, and differs from all the other species of the genus in its peculiar deep yellow coloration.

The 12 specimens on which *T. aureus* is based were collected by Mr. Charles P. Rowley, at Bluff City, Utah (altitude 4500 feet), May 10–24, 1892. Two are young adults (probably young of the previous year), the others middle aged or old. Most of the specimens are in molt, and hence in the patchy, transition stage. Two or three have nearly completed the new dress, described above as the post-breeding pelage ; several others retain for the most part the preceding pelage, or that of winter (described above as the breeding pelage); the others are in mixed dress. They thus present a wide range of color variation, those in old worn pelage being yellowish gray, with the dusky under fur showing through the surface, while those in the new dress are deep golden with the pelage of the lower surface entirely clear white to the roots of the hair; others combine both colorations, arranged more or less in patches.

Several females which probably had young show the number of mammæ to be 6, two pairs being pectoral and one pair inguinal, the two axillary pairs found in some of the other species of the genus (as *T. clusius*) being absent.

Thomomys fossor, sp. nov.

Size large. Claws strongly developed. Interparietal large, strongly convex in front; nasals terminating posteriorly on a line with the intermaxillaries.

Above dusky brown, the hairs slightly tinged with gray, the middle of the dorsal region, from the front of the head posteriorly, with a strong wash of very dark chocolate brown; sides grayer with less brown; under surface grayish plumbeous, the hairs slightly tipped with pale buff or whitish (in different specimens). Muzzle plumbeous black, extending laterally into the cheek pouches; chin and middle of throat pure white; the usual blackish aural area, extending posteriorly as a sharply defined black streak; feet whitish; basal two-thirds of tail blackish, passing into clear white at the tip.

Measurements.—Total length, 293 mm.; tail, 64; hind foot, 30. (Average of two adult specimens, male and female, measured by the collector before skinning.)

Skull.—The skull (Pl. I, Figs. 10 and 11) is of about the size and general form of the skull of *T. bulbivorus*, except that the interorbital portion is much broader, and the rostral portion much stouter. The interparietal is large, subtriangular, and the nasals and intermaxillaries terminate posteriorly on the same line.

A large full-grown skull (No. 4120, ♂ ad.) measures as follows: Total length, 40 mm.; basilar length, 37; greatest breadth, 23; least interorbital breadth, 6; length of nasals, 15; interparietal, breadth transversely, 7, anteroposteriorly, 6.

Type, No. $\frac{5740}{4120}$, ♂ ad., Florida, La Plata Co., Colorado (altitude 7200 feet), June 25, 1892, Charles P. Rowley, collector.

This species, in its dark chocolate brown color, and in the posterior termination of the nasals and intermaxillaries on the same line, and in the large size and subtriangular form of the interparietal, is very distinct from any other known to me. It certainly needs no comparison with any of the species whose habitats immediately adjoin its own.

Thomomys fossor is based on five specimens, two old adults and three nearly adult, collected at Florida, La Plata Co., Colorado (altitude 7200 feet), June 21–26, 1892, by Mr. Charles P. Rowley.

Thomomys toltecus, sp. nov.

Thomomys umbrinus ALLEN, Bull. Am. Mus., V., p. 28, March, 1893.

Above grayish pale rufescent brown, the middle of the back strongly varied with blackish; below pale grayish buff. Feet and tail like the lower surface; tail scantily haired; nose and sides of face blackish; chin and throat nearly concolor with the lower surface; inner edge of cheek-pouches broadly pure white.

Measurements (approximate from unfilled skins).—Total length, 230 mm.; tail vertebræ, 60; hind foot, 27; middle claw of fore foot, 12.

Skull.—(Plate I, Fig. 13.) Total length, 43; basilar length, 40; greatest zygomatic breadth, 27; least interorbital breadth, 7; length of nasals, 14.

Type, No. $\frac{5440}{4305}$, Juarez, northern Chihauhau; Lumholtz Collection, A. D. Meed, collector.

This species is based on six specimens, collected at the Mormon settlement of Juarez, northern Chihuahua (not Sonora as first stated, *antea*, p. 28). They are unfilled, much shrunken skins, with the skulls inside, a part of which have been removed for study, but they prove to be more or less defective, from mutilation of the occipital portion. The best one is that figured in Plate I (Fig. 13). The skulls are heavily ossified, and indicate an animal of about the size of *T. bottæ*. The coloration above is a peculiar pale grayish brown, lighter on the sides and nearly black along the median line of the back. The upper incisors have a slight sulcus at the inner margin of their anterior face.

T. toltecus needs no comparison with *T. fulvus*, its nearest geographical ally, which it exceeds greatly in size, and from which it differs widely in coloration, and radically in cranial characters.

The specimens above described were at first (l. c.) referred to *Thomomys umbrinus*, as defined by Baird, but subsequent study of the group (as detailed below), has shown that at least a portion of

Baird's specimens thus indentified by him were really *T. fulvus*; and also that the *T. umbrinus* of Richardson is probably hopelessly unidentifiable, and thus must be ignored.

II.—QUESTIONS OF NOMENCLATURE.

As is well known, the genus *Thomomys* has an unfortunate history, as regards especially the type localities of the six species named by Richardson during the years 1828 to 1839, very few of them being definitely known to even Richardson himself. This, together with the faulty descriptions and lack of proper figures, laid the foundation for endless complications of nomenclature and doubt as to the real nature of Richardson's species. Of the twelve names given to members of this group prior to 1885, six were contributed by Richardson, one by Schinz (who simply renamed arbitrarily one of Richardson's species), one by Eydoux and Gervais, one by Woodhouse, one by Wied, one by Baird, and one by Coues. Two of Richardson's species, however, were simultaneously published by Bachman under Richardson's manuscript names. As shown by Dr. Coues, in his review of the group in 1875, "the literature of the whole subject, so far as original work in determination of species is concerned, focuses only in two authors—Richardson, 1829, and Baird, 1857;" to which of course must now be added a third—Coues, 1875. Various compilers had, in the time between Richardson and Baird, gone over the ground, without of course contributing anything of importance to the subject.

In 1857 the late Professor Baird (Mam. N. Amer., pp. 388–404) recognized eight species of *Thomomys*, as follows:

"1. *Thomomys bulbivorus.*—Coast of California, from Tejon Pass to some distance north of San Francisco.

"2. *Thomomys laticeps.*—Coast of northern California (Humboldt Bay).

"3. *Thomomys douglassii.*—Lower valley of the Columbia River, and Puget Sound.

"4. ? *Thomomys borealis.*—Upper valleys of the Columbia, towards Rocky Mountains; probably at higher elevations than *T. douglassii.*

"5. *Thomomys rufescens.*—Upper Missouri and Saskatchewan.

"6. *Thomomys talpoides.*—Shores of Hudson's Bay.

"7. *Thomomys umbrinus.*—Western Texas and New Mexico, along eastern slope of Rocky Mountains, and along the mountains into Sonora.

"8. *Thomomys fulvus.*—Valley of the Colorado and tributaries, from the San Francisco Mountains to Fort Yuma, and across to San Diego."

"Of these," he adds, "I am inclined to believe that *Thomomys borealis* may hereafter be referred either to *T. douglassii* or to *T. rufescens.* What other combinations may be required can only be ascertained hereafter."

Dr. Coues, in 1875 (Powell's Explor. of the Colorado River, 1875, pp. 243–265), reduced the preceding list to one species with three subspecies, and described an additional species, presenting the following tabular combination (l. c., p. 247):

BAIRD, 1857.		COUES, 1875.	
1. *Thomomys bulbivorus.*	Pacific coast region..	BULBIVORUS..	As well marked geographical races of one species not completely differentiated.
2. *Thomomys laticeps.....*			
3. *Thomomys douglassii..*			
4. *Thomomys ? borealis...*	Northeren Interior ..	TALPOIDES...	
5. *Thomomys rufescens ..*			
6. *Thomomys talpoides...*			
7. *Thomomys umbrinus..*	Southern Interior and Lower California..	UMBRINUS...	
8. *Thomomys fulvus.....*			

Within recent years Dr. Merriam has revived (N. Am. Fauna, No. 3, 1890, p. 71) as a full species the *Thomomys fulvus* of Woodhouse, and described as new *Thomomys perpallidus* (Science, VIII, p. 588, Dec. 24, 1886), from the Colorado Desert, and *Thomomys clusius fuscus* (N. Am. Fauna, No. 5, 1891, p. 69), from the mountains of central Idaho, apparently with good reason. From the material now in hand it is evident that the group as a whole needs careful revision, as regards both the nomenclature and the number and the status of the forms. While it is not proposed to attempt such a revision in the present connection, I venture to offer a few comments on the general subject.

Richardson, in the years 1828 and 1829, described four species referable to the genus *Thomomys*, namely, (1) *Cricetus talpoides*,

(2) *Geomys douglasii* (not "douglassii," as usually written, (3) *Geomys umbrinus*, (4) *Diplostoma ? bulbivorum*.

The first (*Cricetus talpoides*) was based on a skin (apparently without skull) "from Hudson's Bay" (Zoöl. Jour. III, 1828, p. 118), "but it was not accompanied by any notice of its precise habitat," though Richardson was "inclined to identify it with a small animal inhabiting the banks of the Saskatchewan" (Faun. Bor.-Am., I, p. 204). Coues in 1875 identified Richardson's animal, satisfactorily to himself, with the Saskatchewan species; and in view of what is at present known of the distribution of the genus in the region north of the United States, the Saskatchewan region may be assumed as the habitat of *T. talpoides*.[1]

The second (*Geomys douglasii*) was based on a skin and skull (an old female) obtained, "by Mr. Douglas, near the mouth of the Columbia" (F. B.-A., I, p. 200, pl. xviii *c*, fig. 1–6, skull). It is added, "These little sand rats are numerous in the neighborhood of Fort Vancouver," situated on the north side of the Columbia River, opposite the mouth of the Willamette, about half-way between the Cascade Mountains and the Pacific Coast. Hence the vicinity of Portland, Oregon, may be taken as the type locality of *T. douglasii*. The figures of the skull are unfortunately too crude to afford decisive characters; yet from these and from the account of the external characters I have little hesitation in accepting Baird's identification of the species, and of refering to it specimens from Fort Steilacoom and northward into British Columbia. (See Plate I, Fig. 1, for an outline drawing of a skull from Ducks, B. C.)

The third (*Geomys umbrinus*) was based on a specimen (a skin with apparently the skull in place) "from Cadadaguios, a town in the southwestern part of Louisiana" (F. B.-A., I, p. 202)—at present,and for many years past, an unknown locality. As Dr. Coues has suggested, "more likely Texas," the probability of this, he adds, being "heightened by the Spanish appearance of the name, as if a corruption of *Cuidad de Aguas*, City of Waters" (l. c., p. 261). Baird referred to it specimens from southern New Mexico and Sonora. Of what Baird's series as a whole may have consisted I cannot at present state, but two of them (No. $\frac{271}{1688}$, Sand Creek, on Cimarron River, N. Mex., and No. $\frac{149}{1131}$, Santa Cruz, Sonora), are unquestionably referable to *T. fulvus* (Woodh.). Before seeing these specimens I had referred to *T. umbrinus* (see *antea*, pp. 28 and 52) a series of specimens from Juarez, northern Chihuahua, representing a species very different from *T. fulvus*. (See outline figure of skull, Plate I, Fig 13, in comparison with Fig. 5 of same plate, representing skull of *T. fulvus*.) In the absence of a definite locality, and owing to the difficulty of recognizing species in this group from a description of merely the external characters, it would seem better to allow the name *umbrinus* to lapse as undeterminable.

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[1] Very strangely, Richardson in 1836 gave the habitat of his *G. talpoides* as "Florida," and renamed the Saskatchewan animal *G. borealis*. *Cf.* Rep. Brit. Ass. Adv. Sci., 1836 (1837) p. 156.

The fourth (*Diplostoma ? bulbivorum*) was based on the skin of a "Camas-rat," from the "banks of the Columbia," an animal said to be very common on the plains of the Multnomah River" (F. B.-A., I, p. 206, pl. xviii *b*, wrongly lettered "*Diplostoma douglasii*"). The large size of this animal, as shown by Richardson's measurements, caused it to prove a stumbling block to Prof. Baird, who assumed that the specimen must have been greatly overstuffed, and that the locality was really somewhere in California. He therefore adopted this name for the "California Gopher," named by Eydoux and Gervais, in 1836, *Oryctomys* (*Saccophorus*) *bottæ*, and this determination was accepted by Coues and generally adopted by subsequent writers. It turns out, however, that neither Baird nor Coues ever saw a specimen of true *T. bulbivorus*, which has strangely escaped collectors till a recent date, and proves to be much the largest species of the genus thus far known, fully equaling in size large specimens of *Geomys bursarius* (see Pl. I, Fig. 14). The discovery of this long lost species is due entirely to my friend, Mr. Gerrit S. Miller, Jr., of Cambridge, Mass., who, in response to my request for specimens of *Thomomys* from the lower Columbia River region has kindly transmitted for examination two fine adult specimens (male and female), collected at Beaverton, Oregon, in May, 1890, identified by him as the true *Diplostoma bulbivorum* of Richardson. In order to give him full credit for this important discovery I requested him to furnish me with something for publication on the subject. He has accordingly done me the great favor to forward the following extracts from an unpublished paper of his, which I take great pleasure in here introducing:

"Three examples of a *Thomomys* collected at Beaverton, Washington Co., Oregon, in the spring of 1890, by Mr. A. W. Anthony, differ greatly from the California animal commonly called *Thomomys bulbivorus* (Rich.). The Oregon specimens are larger and much darker colored than any California examples that I have seen; they differ also in the extent of white markings about the mouth and anus, and in certain cranial characters. Most noticeable of the latter is the peculiar form of the pterygoyds, which are larger and strongly concave internally, with hamulars converging at the tips, thus very different from the form usually found in the genus.

"Richardson (F. B.-A., I, 1829, p. 206) based his '*Diplostoma ? bulbivorum*' on a specimen said to have come from the Columbia River, which circumstance, in connection with the minute description given, leaves no room for doubt that the Anthony specimens represent this long lost species.... The first name based on an animal from California is the *Oryctomys* (*Saccophorus*) *bottæ* of Evdoux and Gervais (Mag. de Zool. VI, 1836, p. 23, pl. xxi) ....The specific name *bottæ* will, as first determined by Baird (Proc. Acad. Nat. Sci. Phila, 1855, p. 335), have to stand for the animal later identified by this author and by subsequent writers in general, with Richardson's *bulbivorus*." (Gerrit S. Miller, Jr., MS.)

As already intimated, I agree emphatically with Mr. Miller's above-given determinations. The Anthony specimens are perhaps a little darker (dusky, almost blackish, with a strong tinge of chestnut) than Richardson's description would lead one to expect; but the agreement in all other particulars is so complete that, taking into account the color variability of the group in general, there seems to be no room for reasonable doubt in the case; and that the species which has so long been recognized as *T. bulbivorus* will have to pass in future under the hitherto little known name *bottæ*, based on specimens from the vicinity of Monterey, Cal.

This completes our survey of the first batch of Richardson's species. In 1837 he mentioned a "*Geomys borealis* Rich., sp. nov." (Rep. Brit. Assoc. for 1836, V, 1837, p. 156) as inhabiting "the plains of the Saskatchewan." *Geomys borealis* Rich. has generally been considered to have been a *nomen nudum* except as described by Bachman in 1839. This, however, seems not to have been strictly the case, as Dr. Richardson further referred to it casually in the Zoölogy of Beechey's Voyage (Zoölogy of the Voyage of the Blossom, 1839, p. 12) under the head of *Geomys townsendii*, where he says: "*Townsendii* differs [from *G. Douglasii*] in having the wood-brown colored back of *borealis*, and is distinguished from the latter by its longer tail. Total length of head and body of *G. Townsendii*, 7½ inches, of tail, 2¾ inches. An individual of *G. borealis* of equal size of body, has the tail a very little exceeding an inch in length, and just equal to that of a young specimen of *Townsendii*, whose head and body measures only 5¼ inches." These remarks relate, as Richardson states, to "specimens of two kinds of sand-rat taken by Mr. Townsend on the plains of Columbia," which, he says, "Dr. Bachman kindly submitted to my [his] inspection." Nothing, however, is here said about the habitat of *G. borealis*; and the natural inference is that "the two kinds of sand-rat taken by Mr. Townsend on the plains of the Columbia" were his *G. douglasii* and *G. townsendii*.

In the same year (1839) Dr. Bachman published descriptions of two species of *Geomys* based on specimens obtained by Townsend (the same specimens above referred to in the quotation from Dr. Richardson), under "manuscript names" given them sometime previously by Richardson, namely, *Geomys borealis* and *Geomys townsendii* (Journ. Acad. Nat. Sci. Phila., VIII, 1839, pp. 103 and 105). Bachman's *Geomys borealis* was based on two Townsend specimens "procured on the Columbia River," one of which, says Dr. Bachman, "I fined identical with one which had been procured by Mr. Douglass, and which was in the possession of Dr. Richardson." As shown by the remarks of Dr. Richardson under *Geomys townsendii*, a part of which have been quoted above (l. c.), Dr. Bachman had submitted these specimens to Richardson, who, as above stated, referred one of them to his *G. douglasii*, for he says: "One, the *G. douglasii*, has a rusty-brown colored fur above, hair brown on the abdomen, and blackish head. Tail, feet and pouches, white. Townsendii differs...." etc.

The inference is that Richardson identified one of these specimens as *G. douglasii* and the others as *G. townsendii*. The *G. douglasii* specimen is certainly one of the two specimens on which Bachman based his *G. borealis*, as will appear more fully later when we come to consider Bachman's types. The third Townsend specimen formed the basis of Bachman's "*Geomys townsendii* (Richardson's Manuscripts)," respecting which he says: "I am obliged to confess that I should not have ventured to publish this species as distinct from the preceding on my own responsibility;" but he modestly defers to "the discriminating eye of Dr. Richardson," who was then preparing a monograph (which appears never to have been published) "of this perplexing genus." "As the species, however," he continues, "will be given under the above name, I have found it necessary to indicate it here." Later, however, in Audubon and Bachman's 'Quadrupeds of North America' (III, 1853, p. 198, pl. cxlii), "*Geomys townsendii* Rich." is synonymized under "*Pseudostoma borealis*." The same disposition of *Geomys townsendii* was also made by Baird in 1857 (Mam. N. Am., p. 396), and practically also by Le Conte in 1852, after an examination of the Townsend specimens.

Fortunately these historic specimens are still extant, and through the kind intervention of Mr. Witmer Stone, Curator of Birds and Mammals at the Philadelphia Academy of Natural Sciences, and the courtesy of the Council of the Society, they have been forwarded to me for examination. They each bear two labels, one of which is of recent origin, the other of very early date (at least prior to 1852, as will be shown later). The specimens have been mounted, and were for many years on exhition, but not recently, as they were later dismounted and placed in drawers. They have unquestionably faded somewhat from exposure to light, but still can be distinguished on comparison with Bachman's descriptions of them published half a century ago. The skulls are still in the skins and thus are unavailable for examination. The earlier (original?) set of labels reads as follows, the numbers, however, being taken from the newer set:

[146.] "*Pseudostoma Townsendii* (Rich.). Rocky Mts. J. K. Townsend."

[147.] "*Pseudostoma Richardsonii.* Rocky Mts. J. K. Townsend." The name "*Richardsonii*" has been cancelled and the name "*Townsendii*" written below in pencil in what appears to be Prof. Baird's handwriting. Apparently "*Richardsonii*" was a *lapsus pennæ* for *Townsendii.*[1]

[144.] "*Pseudostoma borealis.* Columbia River. J. K. Townsend." (This specimen is now without its tail, which has apparently become quite recently detached.)

This last is a small specimen, less than half the size of the others, and yet does not show any special marks of immaturity. It has a "deep yellow wash" over the dorsal surface, and is thus evidently "the young specimen" in which "the back had a deep yellow wash," mentioned by Bachman under *Geomys borealis* (l. c., p. 104). It is also beyond doubt the specimen referred to by Richardson (as cited above) to his *Geomys douglasii.*

A careful comparison of the other specimens with Bachman's paper shows that No. 147 is the type of his *G. townsendii*, and that No. 146 is the type of his *G. borealis.* Although No. 147 is rather darker, or more dingy gray, and less washed with yellowish than No. 146, there is nothing to suggest that they are not conspecific, in accordance with the decisions of Bachman, Le Conte, and Baird.

Now a word as to questions of synonymy and type localities involved in the case of *Geomys borealis* Rich. versus *Geomys borealis* Bach. The names are practically of even date, as we must accept *G. borealis* Rich. at 1839 instead of 1837, when it was first named but not described. The only clue to the type locality of *G. borealis* Rich. is that given in his first reference to the species, where it is stated that it "inhabits the plains of the Saskatchewan" (Rep. Br. Ass. Adv. Sci. for 1836, p. 156). Therefore until it is shown that two species of *Thomomys* inhabit the Saskatchewan region, one of which is a short-tailed animal (tail an inch long with a head and body of 7½ inches), agreeing with Richardson's later reference to his *G. borealis*, this name may be dismissed as a synonym of *Thomomys talpoides*. In fact, it seems evident that Richardson here merely renamed the Saskatchewan animal which he had previously referred to his "*Geomys? talpoides*," based on a specimen received from "Mr. Leadbeater, who obtained it from Hudson's Bay" (F. B.-A., I, p. 204); at the same time, for some unexplained reason, changing the habitat of *talpoides* from "Hudson's Bay" to "Florida."[1]

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[1] That these early labels were written many years ago is evident from the fact that in a paper on the genus *Geomys*, published in 1852 by Dr. John L. Le Conte (Proc. Acad. Nat. Sci. Phila., 1852, p. 161), Dr. Le Conte says: "There is a third specimen in the Museum of the Academy labeled '*Pseudostoma Richardsonii*, Columbia River, J. K. Townsend,' which only differs...." etc., the reference being obviously to this specimen.

Bachman's *Geomys borealis* was based on two specimens, a large and a small one, the first from the "Rocky Mountains," the other from the "Columbia River," taking the localities as entered on labels still attached to them and written at least prior to 1852. The smaller specimen is evidently referable to *T. douglasii*, as determined long since by Richardson, who may be presumed to have known his own species. The larger one, on which the description is based, came presumably from near Bridger's Pass in the Rocky Mountains. It is not therefore identical with *G. borealis* of Richardson, though so supposed by Bachman. The name is therefore practically preoccupied and must fall; but as Bachman's *G. townsendii*, which is also Richardson's *G. townsendii*, was based on another specimen of the same species, as admitted by Bachman and later claimed by Le Conte and Baird, from an examination of the same specimens, the name *Thomomys townsendii* (Rich.) may stand for the large, rather pale form of *Thomomys*, known to occur in the Bridger country in common with the smaller *T. clusius*.

Among the specimens kindly loaned me by Mr. True from the National Museum is a specimen (No. $\frac{15468}{22943}$, labeled *Thomomys clusius*) from Fort D. A. Russell, Wyoming, collected in June, 1886, which so closely resembles the larger Townsend specimens that it seems unquestionably referable to the same species. This would seem to support the locality, namely, "Rocky Mountains," given on the labels of the larger Townsend specimens, and lead to the inference that they were collected somewhere in what is now southwestern Wyoming.

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[1] Dr. Richardson's reference to the species of *Geomys*, in his celebrated 'Report on North American Zoology' is as follows: "*Geomys borealis* inhabits the plains of the Saskatchewan. *Douglasii* and *bulbivorus* those of the Columbia, *talpoides* from Florida, *umbrinus* from Louisiana, *Drummondii* from Texas, and *mexicanus*, as the name imports, from Mexico" (Rep. Br. Ass. Adv. Sci. for 1836, 1837, p. 156).

Prof. Baird doubtfully referred a specimen from Canoe Creek, Cal. (No. $\frac{1260}{2225}$), to *Thomomys borealis.* Only the skull is now extant, which is before me. It is that of a quite young animal, and I have little doubt is referable to *T. townsendii*, as Baird's account of the external characters favors this reference. The skull shows that it is not my *T. monticolus* from the mountains of Central California.

Through the kindness of Mr. True I have also before me the type of *Thomomys clusius* Coues (No. 3051, skin with the skull inside), from Bridger's Pass, collected July 28, 1857. As stated by Dr. Coues it is a female, which from the appearance of the teats may have suckled young, and hence is to be regarded as a full-grown animal, though so very small. It is in thin, worn pelage, with patches of the newer coat appearing along the median line of the back, especially anteriorly. I am also indebted to Dr. Merriam for a specimen (No. $\frac{23482}{30900}$) he has identified as *Thomomys clusius* (N. Am. Fauna, No. 5, 1891, p. 69), from Birch Creek, Idaho, and also for others from Bridger's Pass. They differ a little in color from the type of *clusius*, and also among themselves, even irrespective of season. The skull of the type of *clusius* is unfortunately not available for examination.

In 1839 (a memorable year in the history of the genus *Thomomys*), Prince Maximilian zu Wied described his *Thomomys rufescens*, gen. et spec. nov. What may be considered as the type specimen is still extant in this Museum (No. 637), bearing the following on the original label: "*Thomomys rufescens* Wied, Mas. Missouri. Machtohpka indigen." The exact locality is not indicated. In his original account of the species he says: "Diese Wühlmaus ist zalreich in den Prairies des oberen Missouri bis zu den Rocky-Mountains; ich kann aber nicht sagen, wie weit sie südlich und nordlich verbreitet ist" (Nov. Act. Acad. Cæs.-Leop., XIX, pt. i, 1839, p. 382). After over fifty years of exposure as a mounted specimen the color has evidently greatly changed, it in fact closely resembling that of the type of *Geomys townsendii* Bach. (No. 146, Coll. Acad. Nat. Sci. Phila.)! Both have the same faded yellowish gray tint, with the dorsal region strongly washed with yellowish brown, quite unlike the color of unfaded Upper Missouri specimens of *Thomomys*. It has, however, the heavy claws of *T.*

talpoides as distinguished from the thinner smaller claws of the Townsend specimens. The original description calls for an animal not unlike the specimens collected by Dr. Coues (and now before me) at Pembina, Dakota, namely, with the upper parts uniform gray-brown, somewhat mixed with reddish brown and dark gray brown. The dark tint of the gray brown has disappeared, leaving only the reddish brown, which has faded to rather bright yellowish brown. Whether *T. rufescens* is separable, even as a subspecies, from true *talpoides* of the Saskatchewan region I am unable at present to even consider, owing to lack of material.

The type of Prof. Baird's *Thomomys laticeps*, from Humboldt Bay (No. $\frac{573}{1648}$), of which I am able to examine both skin and skull, is evidently closely related to *T. bottæ*, and hence has nothing to do with true *T. bulbivorus*. The skull indicates a very old individual; it is somewhat broken, but enough remains to show the essential characters. It differs from *T. bottæ* (Baird's *T. bulbivorus*) in the much greater breadth and shortness of the rostral portion of the skull, resulting in very short and very broad nasal bones, as pointed out by Baird. I find no skull very nearly approaching it in a large series from Marin Co., California, and from southern California.

T. laticeps also differs from *bottæ* in coloration, as well stated by Baird. For the present it seems proper to recognize *T. laticeps* as a full species, although the comparison of further material may show that it intergrades with *T. bottæ*, as seems not improbable. I refer to it also a series of five specimens from Fort Crook, Cal., collected after the publication of Prof. Baird's 'Mammals of North America,' as they agree essentially in cranial characters and in coloration with the type of *T. laticeps*.

Thomomys clusius fuscus Merriam is apparently more closely related to *T. douglasii* than to *T. clusius*, the points through which it differs from *clusius*—darker coloration, larger size, and thicker, stronger claws—being in the direction of *douglasii*. Judging from Dr. Merriam's description of *clusius* and the two specimens he has kindly sent me for examination, it seems likely to prove a subspecies of *douglasii* rather than of *clusius*, and will be found thus entered in the subjoined list of the species of the genus.

One of the *fuscus* specimens seems quite indistinguishable from examples of *douglasii* from Fort Steilacoom, and Ducks, B. C. The cranial characters, and especially the relative size and the form of the interparietal bone, are very similar in *douglasii*, *clusius* and *fuscus*, and not very different in *talpoides*. The coloration and the size of the claws, however, appear to readily separate *clusius* from the others, which is also the smallest known form of the genus.

III.—CRANIAL CHARACTERS.

It is worthy of note that the cranial characters in the genus *Thomomys* are very important, even when the coloration and external characters may fail to be satisfactorily diagnostic. Prof. Baird had very few skulls for examination at the time he wrote of the group in 1857, and appears to have made very little use of those he did have as a basis for classification. Dr. Coues must have been much better provided in this respect, but his distinctions and generalizations appear to have been based entirely on external features, there being no reference to the skull in his long discussion of the relationships of the various species of previous authors. The importance of the cranial characters for the discrimination of the species of *Thomomys* is evident from a glance at the figures given in the accompanying plate (Pl. I).

The skull varies not only greatly in size and proportions in the different species, but in various important details of structure, as in the shape and relative size of the interparietal bone; in the posterior extension of the nasals as compared with the intermaxillaries; and in the relative development of the muzzle in comparison with the rest of the skull.

In fact, the case is quite parallel to that of the genera *Dipodomys*, *Perodipus* and *Perognathus*, where, especially in the latter genus, Dr. Merriam has found such excellent cranial characters. It is hence evident that the group embraces not one or two species, as believed by Dr. Coues, or eight, as recognized by Prof. Baird, but a considerably larger number, easily characterized by cranial differences, and generally by more or less obvious external features.

The interparietal varies from nearly complete obsolescence, as in *T. bulbivorus* (Fig 14) to a large subquadrate bone, having a transverse breadth nearly equal to half of the intermastoid breadth of the skull, as in *G. monticolus* (Fig. 3) and *G. douglasii* (Fig. 1). It may form a narrow triangle, with the base formed by the occipital border, and twice as long as broad, as in *G. bottæ* (Fig. 8), or triangular with a broad base (the two extreme diameters about equal), as in *T. fossor* (Fig. 10) ; or much smaller, but of the same general form, as in *G. perpallidus* (Fig. 12) ; or rather large and quadrate, as in *T. fulvus* (Fig. 5), or smaller and of the same form, as in *T. aureus* (Fig. 6) and *G. toltecus* (Fig. 13) ; with, of course, intermediate stages in other species, beween these leading types.

The nasal bones may terminate far in advance of the nasal branch of the intermaxillaries, as in *T. bottæ* and *T. aureus*, or on the same line with them, as in *T. fossor*, or, in other species, at various intermediate points. They may be long and narrow, as in *T. monticolus* and *T. douglasii*, or short and narrow, as in *T. fulvus*, or short and broad, as in *T. laticeps*.

The form and position of the various foramina also vary more or less in different species, as do also the size and shape of the hamular processes of the pterygoids, and the outline of the crowns of the molar teeth. The slight sulcus at the inner edge of the anterior surface of the incisors may be nearly or quite obsolete or well developed.

The general size of the skull varies between wide extremes, as shown by a comparison of the skull of *T. fulvus* (Fig. 5) or *T. clusius* (Fig. 2) with the skull of *T. bulbivorus* (Fig. 14).

There is of course more or less individual variation in all of these features, and much variation in size due to age, even after the individual has reached the breeding age ; but an effort has been made to eliminate this in selecting skulls for illustration by taking average specimens of the particular species in question. In several instances two skulls of the same species have been figured, for the purpose of showing variations in size, etc., due to age.

IV.—SPECIES AND SUBSPECIES OF THE GENUS THOMOMYS.

The views reached in the preparation of the present paper may be summarized somewhat as follows, as regards the status of forms and questions of nomenclature. The sequence of the species here adopted is not intended to represent their genetic relationships; it is essentially that of Prof. Baird's list, with interpolations.

1. *Thomomys bulbivorus* (Rich.). — Lower Columbia River. (Beaverton, Washington Co., Oregon, *Miller*; Multnomah Co., Oregon, *Richardson.*)

2. *Thomomys laticeps* Baird.—Northern California. (Humboldt Bay, *Baird*; Fort Crook, Shasta Co., *Feilner.*)

3. *Thomomys bottæ* (E. & G.).—Central and Southern California. (= *T. bulbivorus* Baird, *nec* Rich.)

4. *Thomomys townsendii* (Rich.). — Southwestern Wyoming? (= *Geomys townsendii* Bach. and *G. borealis* Bach., *nec* Rich., the latter in part only.)

5. *Thomomys monticolus* Allen.—Mt. Tallac, El Dorado Co., Cal.

6. *Thomomys douglasii* (Rich.).—Lower Columbia River, and thence northward into British Columbia.

7. *Thomomys douglasii fuscus* (Merriam).—Mountains of Central Idaho.

8. *Thomomys clusius* Coues. — Southwestern Wyoming and Southern and Central Idaho. (Fort Bridger, *Coues*; Snake Plains, *Merriam.*)

9. *Thomomys talpoides* (Rich.).—Saskatchewan region, south to upper Missouri region. (= *Geomys borealis* Rich.; =? *T. rufescens* Wied.)

10. *Thomomys fulvus* (Woodh.).—Southern New Mexico and northern Sonora westward to southern California. (= *T. fulvus* Baird and *T. umbrinus* Baird, the latter at least in part.)

11. *Thomomys perpallidus* Merriam. — Colorado Desert in southern California, and northeastward to the Painted Desert in Arizona (*Merriam*).

12. *Thomomys aureus* Allen.—San Juan region of southeastern Utah.

13. *Thomomys fossor* Allen.—La Plata Co., Colorado (upper San Juan region).

14. *Thomomys toltecus* Allen.—Northern Chihuahua (Juarez).

As already stated, *T. laticeps* may prove to be only a subspecies of *T. bottæ*. On the other hand, *T. rufescens* Wied may prove subspecifically separable from *T. talpoides*, as it is quite unlikely that the *Thomomys* occurring as far south as Fort Randall, in South Dakota, will prove strictly identical with the form found over the Saskatchewan Plains. Again, a form of *Thomomys* occurs in Los Angeles, San Bernardino, and San Diego Counties, California, which is quite different from either *T. bottæ* or *T. fulvus*, and apparently intermediate, in both cranial and external characters, between them. Also the form occurring in southeastern New Mexico and western Texas may not be identical with either *T. fossor*, *T. toltecus* or *T. fulvus*. These are left as open questions, to be solved by some future investigator who may chance to have the requisite material.

EXPLANATION OF PLATE I.

(All the Figures are natural size.)

Fig. 1. *Thomomys douglasii*, No. $\frac{1473}{2125}$,[1] A. M. N. H., Ducks, B. C., Aug. 8, 1889.

Fig. 2. *Thomomys clusius*, No. $\frac{30900}{23482}$, U. S. Dept. Agl., ♂ ad., Birch Creek, Idaho.

Fig. 3. *Thomomys monticolus*, No. 86, Leland Stanford University, ♂ ad., Mt. Tallac, El Dorado Co., Cal., Aug. 8, 1892. *Type.*

Fig. 4. *Thomomys monticolus*, No. 59, Leland Stanford University, Mt. Tallac, Aug., 1892. (A younger specimen than No. 86.)

Fig. 5. *Thomomys fulvus*, No. $\frac{741}{1168}$, A. M. N. H., ♀ ad., San Francisco Mountain, Arizona, July 22, 1887.

Fig. 6. *Thomomys aureus*, No. $\frac{4123}{5243}$, A. M. N. H., ♀ ad., Bluff City, Utah, May 12, 1892. *Type.*

Fig. 7. *Thomomys aureus*, No. $\frac{4128}{5248}$, A. M. N. H., ♂ ad. (very old), Bluff City, Utah, May 18, 1892.

Fig. 8. *Thomomys bottæ*, $\frac{911}{1733}$, A. M. N. H., ♂ ad., Nicasio, Cal., Feb. 26, 1889.

Fig. 9. *Thomomys bottæ*, No. $\frac{909}{1781}$, ♀ juv., Nicasio, Cal., Feb. 26, 1889.

Fig. 10. *Thomomys fossor*, No. $\frac{4120}{5240}$, A. M. N. H., ♂ ad., Florida, La Plata Co., Colorado, June 25, 1892. *Type.*

Fig. 11. *Thomomys fossor*, No. $\frac{4118}{5238}$, ♀ juv., Florida, La Plata Co., Colorado, June 22, 1892.

Fig. 12. *Thomomys perpallidus*, No. $\frac{2614}{3335}$, A. M. N. H., ♂ ad., Baregas Springs, Colorado Desert, California, Dec. 21, 1889.

Fig. 13. *Thomomys toltecus*, No. $\frac{4305}{5410}$, A. M. N. H., adult, Juarez, northern Chihuahua, Autumn, 1890. *Type.*

Fig. 14. *Thomomys bulbivorus*, No. $\frac{226}{304}$, Coll. Gerrit S. Miller, Jr., ♂ ad., Beaverton, Oregon, May 12, 1890.

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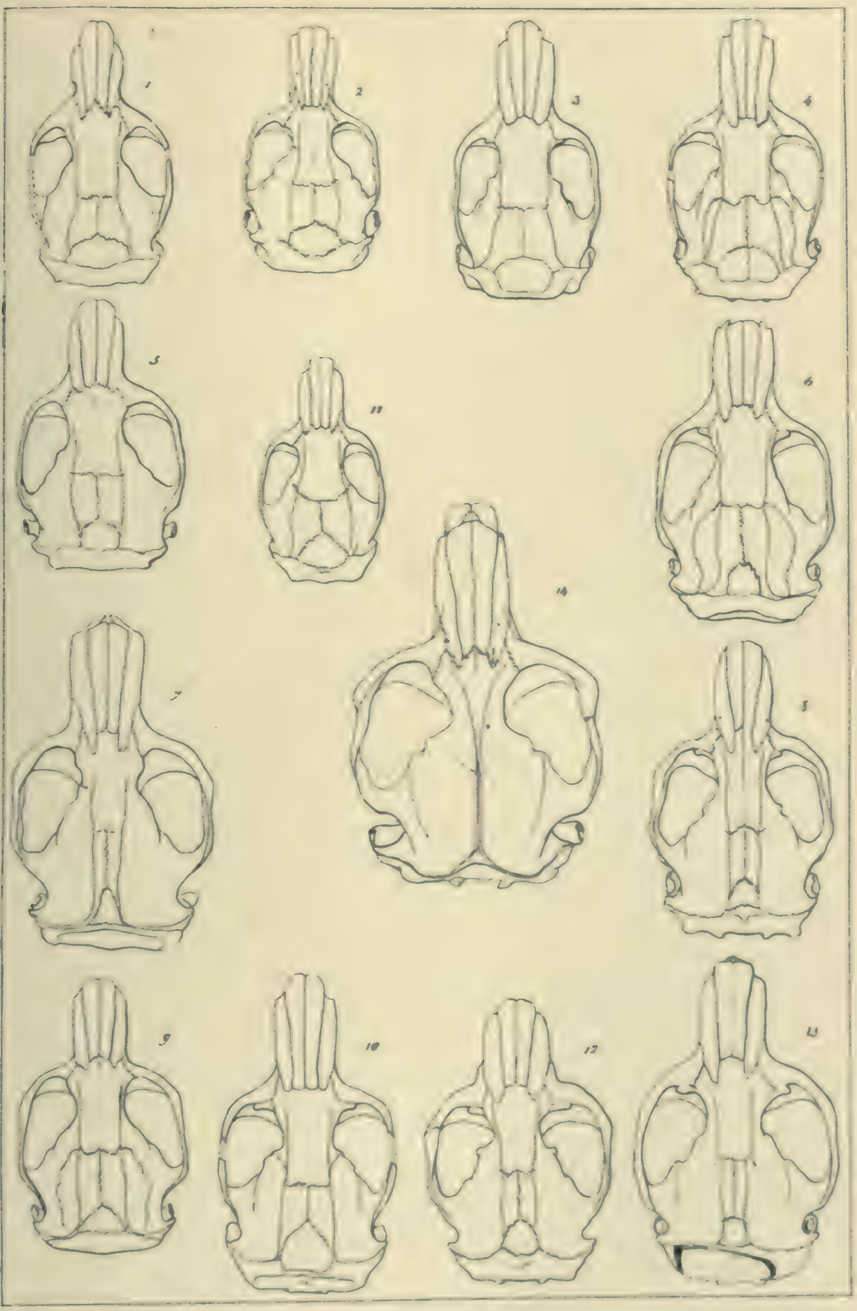
[1] The number above the line denotes the skull, and that below the line the skin of the same specimen.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1. Thomomys douglasii.
2. " clusius.
3, 4. " monticolus.
5. Thomomys fulvus.
6, 7. " aureus.
8, 9. " bottæ.
10, 11. " fossor.
12. Thomomys perpallidus.
13. " toltecus.
14. " bulbivorus.

Article VI.—LIST OF MAMMALS COLLECTED BY MR. CHARLES P. ROWLEY IN THE SAN JUAN REGION OF COLORADO, NEW MEXICO AND UTAH, WITH DESCRIPTIONS OF NEW SPECIES.

By J. A. Allen.

The collection of mammals forming the basis of the present paper was made in a triangular area at the junction of Colorado, New Mexico and Utah, in the valley of the San Juan River, by Mr. Charles P. Rowley, from March 12 to July 11, 1892, in connection with the 'Illustrated American' Exploring Expedition. The thanks of the Museum are due in this connection to the proprietors of the 'Illustrated American' magazine for inviting the Museum to send a representative to accompany its expedition, and for facilities afforded Mr. Rowley in prosecuting his work.

Mr. Rowley began work at Durango, Colorado (altitude, 6500 feet), March 12, and after spending a few days here moved south twenty miles to Aztec, New Mexico (altitude, 5900 feet), where he remained from March 17 to March 27. He reached La Plata, New Mexico (altitude, 6100 feet), twenty miles south of Aztec, March 30, and remained there two weeks. A few days (April 20–23) were spent at Nolan's Ranch, Utah (altitude, 5025 feet), sixty miles northwest of La Plata. Riverview, fifty miles further down the river, was reached April 25, where ten days were passed, when the party moved forty miles further down the San Juan to Bluff City (altitude, 4500 feet), Utah; here collecting was prosecuted till May 26. The expedition then returned to Durango, Colorado, the starting point, and disbanded. Mr. Rowley, however, remained in the field for another month, selecting Florida, La Plata Co., Colorado, eighteen miles east of Durango, and at an altitude of 7200 feet, as his field of operations.

Durango and Florida, in Colorado, and Aztec and La Plata, in New Mexico, are at about the lower border of the pine region in the mountains, while Nolan's Ranch, Riverview and Bluff City, in Utah, are in the open arid cañon country, with a very different fauna from that met with at the points named in Colorado and New Mexico. In Utah the underlying rock is a light-colored soft sandstone, much cut by denudation into gorges, giving a whitish sandy soil, which supports the usual scanty semi-desert vegetation of cactuses, sage-brush and greasewood, and associated characteristic plants; in the more mountainous country to the eastward the soil is dark, and the vegetation is much more abundant, with pines and aspens on the higher slopes and cottonwoods and willows along the river bottoms. The Mice, Ground Squirrels and Pocket Gophers of the mountains are replaced in the open cañon country by not only very different species, but by species characterized by yellowish or bright tawny colors instead of the darker and more rufous tints of their representatives in the mountains to the eastward.

The collection obtained by Mr. Rowley numbers nearly 400 specimens, representing thirty species, while his note books refer definitely to a number of others not obtained. The collection includes two new and very distinct species of *Thomomys* (see *antea*, pp. 49–52), two new species of *Sitomys*, one of *Arvicola*, one of *Reithrodontomys*, and one of *Zapus*. The collection helps to determine the eastern limit of a number of Great Basin species, and the western limit of several of the mountain forms.

1. **Lepus sylvaticus**, subsp.?—Represented by a skull found at Aztec, N. Mex.

Mr. Rowley states that 'Cotton-tails' were not abundant, and that he saw but one, and that only two 'Jack Rabbits' were seen. The latter do not occur in the mountains, but are found lower down in the open country to the westward.

2. **Cariacus macrotis** (*Say*).—"Common at Florida in spring; pass lower down to winter" (Rowley, MS. notes). No specimens were obtained.

He also states that a few Elk (*Cervus canadensis*) still occur about Florida, and that Mountain Sheep (*Ovis canadensis* Shaw) are still taken at long intervals. "None seen or killed this year so far (July, 1892)."

3. **Erethizon epizanthus** *Brandt*.—La Plata, N. Mex., April 8, one specimen. Locally common.

4. **Thomomys fossor** *Allen.* — Florida, La Plata Co., Colorado, 5 specimens, June 21–26. (See *antea*, p. 51.)

5. **Thomomys aureus** *Allen.*—Bluff City, Utah, 14 specimens, May 10–24. (See *antea*, p. 49.)

6. **Perognathus apache** *Merriam.*—The series of 35 specimens of this species was all taken at Riverview, Utah, April 25 to May 4, where it was a common species, but apparently it was not met with at other points.

The identification has been made by direct comparison of some of the specimens with Dr. Merriam's type, which "came from the high mesa on the east side of the Painted Desert," Arizona, about 125 miles southwest of Riverview. The series presents considerable variation in color, even among the adults, the fulvous of the upper parts varying from pale to strong bright fulvous, generally much varied with black above the lateral line, but in one specimen bright fulvous predominates over the black, while generally the black greatly predominates over the fulvous. In very young specimens the fulvous is pale and limited mainly to the post-auricular patch, and the broad lateral line, the dorsal surface approaching an olivaceous gray finely and slightly varied with black. This coloration is seen in some nearly full-grown examples.

7. **Perodipus ordii** (*Woodhouse*).—Two specimens, male and female, Bluff City, Utah, May 16 and 17. Not common, and not met with elsewhere.

8. Zapus princeps, sp. nov.

Of the size of *Z. insignis* Miller, but with the dental formula of *Z. hudsonius*; quite different from either in coloration.

Above with the middle of the dorsal region pale yellowish brown, profusely mixed with blackish, so that sometimes the blackish color, sometimes the pale yellowish brown, predominates; sides of the body, forming a band on either side about equal to the dark dorsal band, yellowish brown slightly varied with blackish, except over a narrow lateral line adjoining the white of the lower parts which is clear strong yellowish brown; lower parts pure white to the base of the hairs, varying in some specimens to strong ochraceous; tail indistinctly bicolor—grayish white below and pale brown above, and very thinly haired; hind feet grayish white above, like the lower surface of the tail; ears narrowly edged with yellowish white.

Measurements.—Total length (from collector's measurements taken before skinning), 238 mm. ; tail, 144 ; hind foot, 36 ; ear from crown (measured from skin), 12. (Average of 12 adult specimens, 7 ♂, 5 ♀.)

Skull, total length, 24.5 ; basilar length, 20.3 ; greatest cranial breadth, 11.5 ; least interorbital breadth, 5 ; length of nasals, 10.

Type, No. $\frac{5260}{4140}$, ♀ ad., Florida, La Plata Co., Colorado, June 27, 1892 ; coll. Charles P. Rowley.

This species about equals in size *Z. insignis*, 10 specimens of which average in total length 240 mm. ; tail, 148 ; hind foot, 31.5 ; ear, 17.5. *Z. hudsonius* averages in length about 210, tail about 128, hind foot about 29.5, and ear about 14.[1] *Z. princeps* differs from both these species in its much paler coloration, and from *Z. hudsonius* in its much larger size, and from *Z. insignis* in the presence of a small upper premolar. Although this tooth, both absolutely as well as relatively, is smaller than in *Z. hudsonius*, it is uniformly present, while in *Z. insignis*, as shown by a large series of specimens, it is uniformly absent. This latter species also differs from both the others in its white-tipped tail, and the very large size of the ears.

Z. princeps is based on a series of 12 specimens, all adult, collected at Florida, La Plata Co., Colorado, June 22 to July 3, 1892, by Mr. Rowley.

The series is very uniform in coloration ; some, however, are a little paler, or grayer in general effect, above than others, while one is strongly marked below with ochraceus, as is frequently the case in *Z. hudsonius*, in fresh pelage. As regards size, one (No. $\frac{5257}{4137}$, ♀ ad.) is much above the average, having a total length of 262 and the tail 168, the total length of the skull being 25.5 and the basilar length 21.

9. **Arvicola (Mynomes) alticolus** *Merriam.*—This species is represented by 11 specimens taken at Florida, La Plata Co., Colorado, June 17–July 4. They are nearly all adult, most of the six females being in breeding condition.

Nine adults give the following averages, based on measurements taken from the fresh specimens by the collector : Total length, 170 mm. ; tail, 60 ; hind foot, 23.

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[1] I am indebted to Mr. Gerrit S. Miller, Jr., of Cambridge, Mass., for the opportunity to examine not only the type of *Z. insignis* but also a large series of this species from Essex County, N. Y., and also a large series of *Z. hudsonius* from Massachusetts and New York, on which the preceding generalizations are mainly based.

In texture of pelage and coloration these specimens agree with two examples of *A. alticolus*, from San Francisco Mountain, Arizona, kindly loaned me for examination by Dr. Merriam, except in the color of the feet and tail, which in the Colorado specimens are slaty gray instead of brownish gray, as in the Arizona examples. The Colorado series apparently averages larger in general size, and may perhaps be subspecifically separable from *A. alticolus.*

10. **Arvicola (Mynomes) aztecus**, sp. nov.

Size large ; pelage very full and soft ; tail short ; skull very narrow.

Above grayish brown with a tinge of pale buff ; fur blackish plumbeous beneath the surface, tipped with pale yellowish brown, and varied with longer, projecting, black-tipped hairs ; below grayish white, the fur plumbeous beneath the surface and tipped with white, giving a whitish gray effect. Feet dusky ; tail dusky brown above, dull white below.

Measurements.—Total length (average of 5 specimens, from collector's measurements taken before skinning), 162 mm. ; tail, 42 ; hind foot, 18 ; ear from crown (measured from skin), 7. The largest measurements are as follows : total length, 170 ; tail, 44 ; hind foot, 21.5 ; the smallest are respectively, 146, 35, 17.3. All the specimens are apparently fully adult.

Skull, total length, 28 ; basilar length, 27 ; greatest zygomatic breadth, 16 ; least interorbital breadth, 4 ; nasals, 8.2.

Type, No. $\frac{5170}{4050}$, ♀ ad., Aztec, New Mexico, April 23, 1892 ; coll. Charles P. Rowley.

This species is not only a member of the subgenus *Mynomes*, but belongs to the *riparius* section, the middle upper molar having the postero-internal loop characteristic of the *riparius* group. It is, however, somewhat larger, very different in coloration, and presents slight but obvious differences is details of cranial structure.

Arvicola aztecus is based on two specimens from Aztec, New Mexico, and three specimens from La Plata, New Mexico, collected April 20–May 9, 1892. I also refer to it a large *Arvicola* from Estes Park, Colorado, which I have before been unable to allocate. I am unable to find that it differs in any particular from the specimens from New Mexico.

The type and only positively identified specimen of Baird's *Arvicola modesta*, from Sawatch Pass, Colorado, is a very young specimen in poor condition. An examination of a series of adult and young examples from the type locality will be necessary in order to determine its relationships to *A. alticolus* and *A. aztecus*. I am indebted to Mr. True for the opportunity of examining what remains of the type of *A. modesta*.

11. **Onychomys leucogaster,** subsp.?—One specimen, La Plata, N. Mex., April 4.

12. **Sitomys[1] sonoriensis** (*Le Conte*).—The Rowley Collection contains 186 specimens of *Sitomys*, 130 of which I refer to what is commonly recognized as *Sitomys sonoriensis*. These specimens were collected as follows: Durango, New Mexico, March 12 and 13, 4 specimens, all adults; Aztec, N. M., March 17–27, 14 specimens, all adults; La Plata, N. M., March 30–April 13, 52 specimens, 44 of which are adults and 8 young; Nolan's Ranch, Utah, April 20–22, 6 adults and 1 young; Riverview, Utah, April 25–May 4, 16 adults and 18 young; Florida, La Plata Co., Colorado, June 11–July 11, 9 adults and 10 young.

Aside from the young specimens, which show every phase of immaturity from half-grown individuals to those which have nearly lost the 'blue' coat characteristic of immaturity, the adults vary widely in color and considerably in size, even in series taken at practically the same date. Thus in the La Plata (N. Mex.) series, the white-rimmed ears and the sharply-bicolored tail are about the only color features that are constant; there is, however, usually a more or less prominent mixture of pure white hairs at the anterior base of the ears, but they are frequently absent. An average specimen may be described as pale grayish fulvous, much varied with black along the middle of the back, with less black and more strongly fulvous on the sides. In some specimens there is a conspicuous bright golden brown lateral line at the junction of the dark dorsal pelage with the pure white of the lower parts; while in other specimens, taken at the same place and on the same day, this bright fulvous lateral line is entirely wanting. In still other specimens a bright fulvous tint suffuses the whole dorsal surface, but is stronger and less obscured by blackish along the sides of the body than along the middle of the back. In other cases the fulvous tint is almost entirely lacking, the whole upper surface being pale grayish buff varied with black, giving almost an olivaceous effect. In other cases the general effect is more blackish; in others there is a pale chestnut or russet effect. Taking the series as a whole, it is evident that some of these effects are due to season—to wear and bleaching; but there is still left a wide range of color variation which has no very evident relation to sex, season, or locality, though possibly dependent to some extent upon age.

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[1] Dr. Merriam has recently shown that the name *Vesperimus* Coues, with which I proposed to replace *Hesperomys* (see this Bulletin, III, pp. 201–204), is antedated by *Sitomys* Fitzinger (Proc. Biol. Soc. Washington, VII, p. 27, April, 1892).

The collector's measurements of 40 adults, taken in the field before skinning, give the average total length (from the nose to end of the tail-hairs) as 6.15 in. (156 mm.), and of the tail alone (including hairs), as 2.65 in. (67 mm.). Few specimens fall below 6 inches in total length, and very few below 5.85, ranging from this up to 6.62, though rarely exceeding 6.50. The tail rarely falls below 2.40, and as rarely reaches 3.00, averaging 2.65. The average for head and body is about 90 mm., and for tail vertebræ alone, 63 mm.

Two breeding females preserved in alcohol have the teats $\frac{1-2}{1-2}=6$, 2 of which are pectoral and 4 inguinal.

This species was very common at the points visited in Colorado and New Mexico, in the partially wooded districts, but not found in the desert country about Bluff City.

13. **Sitomys auripectus,** sp. nov.

About the size of *Sitomys sonoriensis*, with larger and more naked ears, much longer, more heavily clothed and less sharply bicolor tail, which is conspicuously tufted at the end; general color above paler or more yellowish, and less varied with black.

Above pale yellowish brown, or golden brown, slightly varied with blackish-tipped hairs along the middle of the dorsal region; sides of the body, from the cheeks to the rump, clear strong golden brown, this color extending to the carpal and tarsal joints; below pure white, with a broad roundish pectoral patch of yellowish brown, like that of the flanks; basal half of all the hairs plumbeous; tail white below, pale brown above, darkening to blackish apically, thickly haired throughout, the hairs above very long towards the tip of the tail and terminating in a conspicuous brush or heavy pencil of blackish hairs, fully half an inch in length; ears pale brown, with a narrow whitish rim, nearly naked, being very thinly covered with very short hairs on both surfaces; a very narrow, indistinct blackish eye-ring. Proximal third of soles clothed, but less heavily than in *S. sonoriensis*.

Measurements.—Total length (collector's measurements taken before skinning), 172 mm. ; tail, 93 ; hind foot, 22 ; ear from crown (taken from skin) 16. (Average of 10 specimens.)

The skull is similar in size and general form to that of *S. sonoriensis*, and apparently affords no diagnostic characters. Total length, 24.5 ; basilar length, 21 ; greatest cranial breadth, 12.5 ; least interorbital breadth, 5 ; length of nasals, 10.5.

Type, No. $\frac{5117}{3997}$, ♀ ad., Bluff City, Utah, May 14; coll. Charles P. Rowley.

This species is represented by 13 adult and 5 immature specimens, collected at Bluff City, May 8–17. The adults are very uniform in size and coloration, except that the bright yellowish breast patch is indistinct in one of the specimens, apparently quite absent in two others, and strongly developed in eleven. The young specimens are similar to the young of *S. sonoriensis* in corresponding stages except that they are somewhat grayer and paler. Two breeding females in alcohol have the teats $\frac{2}{2}$, all inguinal.

This species is not closely related to any other previously described. Its large ears, bushy tail, yellow breast spot and pale golden brown color are distinctive features. It does not, however, belong to the big-eared section of the genus, containing *S. truei*, *S. megalotis*, *S. nasutus*, etc. The proximal third or half of the soles is well clothed with short, silky, yellowish white hairs, the covered portion extending in some specimens as far as the first tubercle ; in others it is less extended.

14. **Sitomys rowleyi**, sp. nov.

Somewhat similar to *S. auripectus* in general characters, but much larger, less yellowish above, and without the pectoral spot ; soles wholly naked as in *S. eremicus*.

Above dull pale grayish cinnamon brown, varied slightly with blackish-tipped hairs, passing into a band of yellowish cinnamon along the sides of the body ; beneath white, the basal portion of the hairs plumbeous ; tail indistinctly bicolor—dull pale brown above and whitish below—well haired and with a conspicuous terminal pencil. The ears are large, naked, and not obviously edged with white. Teats [illegible], inguinal.

Measurements.—Total length (collector's measurements taken before skinning), 201 mm. ; tail, 106 ; hind foot, 23 ; ear from crown (taken from skin), 15–18. (Average of 12 adults, 6 ♂, 6 ♀.)

Skull, total length, 27 ; basilar length, 23 ; greatest cranial breadth, 13 ; least interorbital breadth, 11 ; length of nasals, 5.5. The skull is much larger than in either *Sitomys sonoriensis* or *S. auripectus*, and differs from them in slight details of structure.

Type, No. $\frac{5870}{3950}$, ♂ ad., Nolan's Ranch, Utah, April 20, 1892 ; coll. Charles P. Rowley.

This species is based on a series of 25 specimens, of which 5 were collected at Nolan's Ranch, April 20–21, and 20 at Bluff City, May 8–24. Of this number 18 are fully adult and present little variation. A full-grown young specimen is nearly uniform mouse gray above, with an indistinct narrow lateral line of yellowish brown. Very young specimens are grayish plumbeous, lighter and more silvery than young of corresponding ages of either *S. sonoriensis* or *S. auripectus*. None of the series shows any trace of the fulvous pectoral spot of *S. auripectus*.

S. rowleyi is very distinct from any other member of the genus known to me. It has a superficial resemblance to *S. auripectus*, but it is a much larger animal and very differently colored, at all ages. It is less yellow above and wholly lacks the pectoral spot ; the tail and soles are rather less hairy.

In their large naked ears, partly naked soles, and long tails both *S. rowleyi* and *S. auripectus* would seem to belong near *S. eremicus*, which they resemble in proportions, rather than with *S. sonoriensis*, but neither is in any way very closely allied to *S. eremicus*.

Some years since a series of 14 mice was received at the Museum from Mr. W. E. D. Scott, collected in October, November and December, 1885, in Pinal County, Arizona, which were provisionally referred to *S. eremicus*. They presented, however, a wide range of variation in color, hairiness of tails and soles, and in size, which rendered them very puzzling. A re-examination of the series in the light of present material shows that only ten of them are to be referred to *S. eremicus*, the other four being apparently referable to the present species, which thus has probably quite a range to the southward.

Since the above was written the Museum has received a series of 12 specimens of *Sitomys*, collected at Bradshaw City, Arizona, in January and February, 1890, by Mr. H. H. Keays, which are also referable to this species.

This species is named for Mr. Charles P. Rowley, whose collection here under notice has proved so rich in new forms and other valuable material.

15. Sitomys truei (*Shufeldt*).

Hesperomys truei SHUFELDT, Proc. U. S. Nat. Mus. VIII, p. 407, pl. xxi, Sept. 1885. (Fort Wingate, N. Mex.)

? *Hesperomys megalotis* MERRIAM, N. Am. Fauna, No. 3, p. 64, pll. iii and iv, Sept. 11, 1890. (Black Tank, Little Colorado Desert, Arizona.)

Eight specimens collected as follows: 2, Aztec, New Mexico, March 20; 6, La Plata, N. Mex., April 2–8.

Aztec is only a few miles south of the northern boundary of New Mexico; La Plata is about thirty miles south of Aztec, and both are near the Arizona line. Fort Wingate is about one hundred miles (probably a little less) south of La Plata, and about one hundred miles or so east of the type locality of *H. megalotis* Merriam, who refers to "specimens of the same or a closely-related form" from Moccasin Springs, Arizona, near the boundary line of Utah and Arizona.

Through Dr. Merriam's kindness I have two of his original specimens (Nat. Mus. Nos. $\frac{17922}{24833}$ and $\frac{17944}{24855}$) for comparison with the Rowley series, which I am unable to distinguish as in any way different. The Rowley series is from near the type locality of *H. truei*, and is practically identical with the type, with which, through the kindness of Mr. True, I have been able to compare them.

Vesperimus nasutus Allen, from Estes Park, Colorado, is evidently nearly related to *S. truei*, as already pointed out (this Bulletin, III, p. 300).

Hesperomys crinitus Merriam, from Shoshone Falls, Idaho, proves to be apparently the same as *S. nasutus*, the latter name, however, having a few weeks priority, the two names being published nearly simultaneously. This shows that the big-eared *truei* group of *Sitomys* has a wide geographical range, although everywhere apparently affecting similar situations—cañons or rocky gorges.

16. Reithrodontomys[1] megalotis (*Baird*).

Reithrodon megalotis Baird, Mam. N. Am. 1857, p. 451 ; Zoöl. Mex. Bound. Sur., Mam. 1859, p. 43, pl. vii, fig. 4, feet and ear, pl. xxiv, fig. 4, skull. (Between Janos, Sonora, and San Luis Springs, N. Mex.)

I refer provisionally 13 specimens to this species, taken as follows : La Plata, N. Mex., 7 specimens (including three in alcohol), March 30—April 11 ; Aztec, N. Mex., 2 specimens, March 19 and 20 ; Riverview, Utah, 1 specimen, April 25 ; Bluff City, Utah, 1 specimen, May 18.

Through the kindness of Mr. True I have the skull of Baird's type for comparison with the present series, and I am unable to perceive any differences other than smaller size. Unfortunately the skin of the type, Mr. True writes me, has been mislaid, and thus is not available in this connection. The series of specimens mentioned above seems to agree closely with Baird's description of his *R. megalotis*, so far as proportions and coloration is concerned, but the measurements taken by the collector from the fresh specimens considerably exceed those given by Baird. The subjoined description was drawn up some time since, under the impression that *R. megalotis* would prove more different from the Rowley specimens that seems to be the case.

As the type locality of *R. megalotis* is near Janos, not far from the boundary line between Sonora and New Mexico, some four hundred miles south of La Plata and Aztec, and in a zöologically quite different region, I have thought best to append the following, in view of the probability that the two forms will prove at least subspecifically separable.

Reithrodontomys aztecus *Allen* MS.

Color above almost exactly like that of an average fully adult house mouse (*Mus musculus*), but with the pelage softer and fuller, and rather more yellowish on the flanks ; below clear grayish white, the fur plumbeous at base and white apically ; tail indistinctly bicolor, pale brown above, grayish white below ; ears concolor with the general tint of the dorsal surface, very scantily haired externally, nearly naked within. Feet dull whitish ; hind feet with the soles well clothed posteriorly, naked anteriorly.

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[1] As pointed out by Dr Merriam *Reithrodontomys* Giglioli (1873) antedates *Ochetodon* Coues (1874) (*Cf.* Merriam, Proc. Biol. Soc. Washington, VII, p. 26 (footnote), April, 1892.)

Measurements (average of 7 adults, from collector's measurements taken before skinning).—Total length, 135 mm. ; tail, 65 ; hind foot, 18 ; ear from crown (average from skin), 12.

Skull, total length, 21 ; basilar length, 19 ; greatest cranial breadth, 11 ; least interorbital breadth, 4 ; length of nasals, 8.

Type, No. $\frac{5162}{4042}$, ♂ ad., La Plata, N. Mex., April 11, 1892 ; coll. C. P. Rowley.

From Dr. Coues's scanty material he was led to assume (Mon. N. Am. Roden., 1877, pp. 125, 126) that "the *Reithrodon megalotis* is the same as *O. humilis*," and on this account apparently gave the habitat of the latter as extending from the "Gulf States into Sonora." They prove, however, to be as unlike in both size and coloration as two congeneric species can well be expected to be ; and I have seen no evidence that *R. humilis* extends even into Texas.

NOTE ON **Reithrodontomys montanus** (BAIRD).—Through the kindness of Mr. True, I have the skin of the type specimen of Baird's *Reithrodon montanus;* the skull, however, is at present unavailable for examination. Although probably not fully mature, it is evident that it represents a species quite unlike either *R. humilis* of the East or *R. megalotis*. Dr. Coues was led to suspect (Mon. N. Am. Roden., p. 130) that the specimen had been immersed in alcohol, and it certainly has that appearance, though not so stated by Baird. The underparts, described originally as "dull whitish," are now yellowish, as though stained either by alcohol or insect powder. The specimen was taken on Capt. Beckwith's Expedition, from what is now eastern Kansas up the Arkansas River and across the divide between the headwaters of the Arkansas and the Grand Rivers, and thence westward. The locality given for the type of *R. montanus* is simply "Rocky Mountains, Lat. 38°." Evidently the type locality was not known, even to Baird, and may have been east of the Rocky Mountains. This seems not improbable from the fact that a species of *Reithrodontomys*, entirely different from either *R. humilis* or *R. megalotis*, occurs in both Kansas and Colorado; it greatly resembles Baird's *R. montanus*, as shown by actual comparison of specimens. In comparison with all of the other known species of the genus, the ears are small and thickly covered with short coarse hair, and the anterior third of the outer surface is occupied by a well-defined blackish spot, conspicuously in contrast with the rest of the outer surface of the ear, which is yellowish brown. This spot is less strongly marked in Baird's type than in other specimens from both Kansas and Colorado, and is not mentioned in Baird's description. I have therefore no hesitation in recognizing *Reithrodontomys montanus* (Baird) as a well-marked, valid species, which will probably be found to range from the eastern base of the Rocky Mountains eastward to middle Kansas.

17. Neotoma mexicana *Baird.*—One specimen, La Plata, N. Mex., April 4.

18. Mus musculus *Linn.*—Florida, La Plata Co., Col., 13 specimens, June 11–July 1.

19. Castor canadensis *Kuhl.*—No specimens taken, but Mr. Rowley reports them (MS. notes) as occurring in numbers along the Florida, Animas, Mancos, and San Juan Rivers.

20. Arctomys flaviventer *Aud. & Bachm.*—An adult female, Florida, La Plata Co., Col., June 16, is provisionally referred to this species. It is, however, very unlike Sierra Nevada specimens commonly referred to this species. "Woodchucks scarce, the only one found was up near timber line. They keep very high up." (Rowley, MS. notes.)

21. Cynomys gunnisoni *Baird.*—Two specimens, Cortez, Col., and Aztec, N. Mex. Also a weathered skull from Aztec. These were the only specimens seen, no villages being met with throughout the journey of nearly 400 miles.

22. Spermophilus grammurus (*Say*).—The six specimens in the collection all belong to one family, consisting of an adult male and female and four young, collected at Florida, La Plata Co., Col., June 25–29. No others were seen, and the species was unknown to the ranchmen of the region.

23. **Tamias lateralis** (*Say*).—A series of 36 specimens from Florida, La Plata Co., Colorado, collected June 11 to July 11, including all sizes and conditions from quarter-grown young to adults, in pre- and post-breeding pelage. The pre-breeding pelage is shown by a female, taken while still nursing young, which is in faded, much worn coat, with no traces of the new coat. It is very pale throughout, in strong contrast with the freshly-molted examples, in which the whole upper parts are much darker—blackish, finely varied with rusty gray, especially anteriorly ; the lateral stripes and sides of the belly are grayish white instead of yellowish white ; the sides of the shoulders are only slightly washed with yellowish instead of being deep reddish orange, resulting in a very different and strongly contrasting general effect. Others present a patchy condition, in which the new coat is more or less irregularly displacing the old. Most of the July specimens have fully acquired the new coat. The young in first pelage have a much thinner, softer, paler coat than the post-breeding adults.

Very common about Florida, but less numerous than *T. quadrivittatus.*

24. **Tamias leucurus cinnamomeus** *Merriam.*—A series of 14 specimens from Bluff City, Utah, May 9–25. They are mostly in worn, patchy, transition pelage, and show both the pre- and post-breeding pelages. One has nearly completed the molt, and one is a quarter-grown young one.

Compared with a series of true *T. leucurus* from San Diego Co., Cal., the difference in color between the two forms is very striking, as pointed out by Dr. Merriam in his description of *T. l. cinnamomeus.* (*Cf.* N. Am. Fauna, No. 3, 1890, p. 52.)

Reported as met with only in the open cañon country about Bluff City.

25. **Tamias quadrivittatus gracilis** *Allen.*—Bluff City, Utah, 9 specimens, May 9–21. They are mostly in worn, transition pelage, showing a mixture of both pre- and post-breeding coats. One has nearly completed the new coat.

These specimens agree very closely with the San Pedro, N. Mex., series on which this very striking form was originally based (this Bull., III, pp. 99–101).

26. **Tamias quadrivittatus** (*Say*).—A series of 49 specimens, collected at Florida, La Plata Co., Colorado, seem to be typically referable to true *T. quadrivittatus*. It consists of both young and adults, the latter in molt.

Very common in the pine belt about Florida, among rocks and in the ground, but readily took to trees when pursued. (Rowley, MS. notes.)

27. **Sciurus aberti** *Woodhouse*.—One specimen, ♀ ad., Florida, La Plata Co., Colorado, June 21. Very rare. This was the only specimen seen, and the species was not known to the residents of the region.

28. **Antrozous pallidus** (*Le Conte*).—Two specimens, Bluff City, May 18 and 25.

29. **Vesperus fuscus** (*Beauvois*).—Two specimens, Bluff City, Utah; one specimen, Florida, La Plata Co., Col.

30. **Vesperugo hesperus** (*H. Allen*).—Three specimens, Riverview, Utah, May 25.

31. **Vesperugo (Lasionycteris) noctivagans** *Le Conte*.—Two specimens, Florida, La Plata Co., Col., June 30.

32. **Vespertilio lucifugus** *Le Conte*. — Three specimens, provisionally referred to this species, Bluff City, May 11 and 16.

33. **Lutreola vison** (*Schreber*).—One specimen, La Plata, N. Mex. "Minks are quite plentiful on all the streams of this region, but I was only lucky enough to catch one, on the La Plata River" (Rowley, MS. notes).

34. **Felis concolor** *Linn.*—"Scarce about here (Florida); one was killed at the head of Florida Creek in February, 1892" (Rowley, MS. notes).

In addition to the foregoing Mr. Rowley refers in his notes to the occurrence of other species he was unable to obtain, as Badgers, which he trapped for unsuccessfully, and Lynxes ("scarce in the mountains about Florida"), Gray Foxes, and Skunks. He reports "Cinnamon Bears," in the mountains about Florida, but "no Grizzlies."

Article VII.—ACERATHERIUM TRIDACTYLUM FROM THE LOWER MIOCENE OF DAKOTA.

By Henry Fairfield Osborn.

Aceratherium tridactylum, sp. nov.

General Characters.—I $\frac{2}{1}$, C $\frac{0}{1}$, P $\frac{4}{3}$, M $\frac{3}{3}$. Digits, 3–3. Vertebræ, D 19, L 5, S 3, C 21. Occiput elevated. Postglenoid and post-tympanic enclose auditory meatus inferiorly. Superior molars with strong 'antecrochet' and 'crochet' feeble or absent. First upper premolar well developed. Incomplete cingulum upon inner face of true molars. Occiput high and narrow.

The very thorough search of the Lower Miocene (White River) exposures of South Dakota by the Museum Expedition of 1892 has resulted in the discovery of a complete series of *Aceratheria* in an horizon which has hitherto yielded but two well-determined species. The smallest of the series was found immediately overlying the 'Titanotherium Beds,' and the largest in the 'Protoceras Beds,' which mark the top of the White River formation in this locality. These forms will be figured and described in a forthcoming bulletin. The present paper is a preliminary description of the largest type, *A. tridactylum*.

The type of this new species is a complete skeleton in excellent preservation, which was discovered by Mr. Peterson of the Museum party, and has now been mounted for exhibition by Mr. Hermann. The only parts lacking are the left forelimb, a few of the ribs, and the sternal bones. All the other parts are complete, the vertebral column being perfect to the tip of the tail.

The skeleton measures seven feet nine inches in length, and four feet in height to the top of the lumbar vertebral spines. There are nineteen dorsal, five lumbar and three sacral vertebræ. The pelvis is long and rather slender, and the limbs are of an intermediate type, heavier than in *A. occidentale* and much longer than in the Upper Miocene *A. fossiger*. There are only three digits in the manus, hence the name *tridactylum*, there being no trace of the fifth digit, which is so characteristic of the lower Miocene Rhinoceroses of America and Europe, with the possible exception of *A. mite* Cope.

The total length of the skull is 51 centimeters, while in *A. occidentale* it measures 44. The occiput is high and rather narrow, whereas in *A. occidentale* it is low and broad; the upper line of the skull thus curves upwards, and the sagittal crest is considerably shortened. Another progressive feature is that the molars show, besides the strong 'antecrochet,' a beginning of the 'crochet,' which is wholly undeveloped in *A. occidentale.* The median upper incisors are much larger than the outer pair, and the lower canines are correspondingly enlarged. The first lower premolar (P1) is rudimentary or wanting.

Another distinctive feature of the skull is the union of the postglenoid and post-tympanic processes to enclose the external auditory meatus inferiorly.

The upper view of the skull, especially in the great elongation of the nasals, which overhang the premaxillaries, suggests a close affinity to *A. megalodus*[1] Cope of the Upper Miocene or Loup Fork; the molars are in a similar stage of evolution; the occiput of *A. tridactylum* is constricted below and spreads above, while that of *A. megalodus* is broad at the base and narrows regularly to the top; a partial cingulum is present upon the inner side of the true molars, and is said to be wanting in *A. megalodus;* the first upper premolar is well developed in *A. tridactylum*, and is variable or wanting in *A. megalodus.* These features are such as usually separate Lower from Upper Miocene types.

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[1] Pal. Bulletin, No. 14, Proc. Am. Phil. Soc., July, 1873.

Article VIII.—NOTES ON TRANSFORMATIONS OF SOME NORTH AMERICAN MOTHS.

By William Beutenmüller.

The following are a few notes on the earlier stages of some Lepidoptera, made by me during the summer of 1891, to which are added the descriptions of several cocoons from Mexico, which are in the Hy. Edwards Collection, and as far as I am aware have not yet been described.

Chionobus semidea *Say.*

Egg.—Received from Dr. S. H. Scudder. Laid about July 15. Larva emerged July 26. Oblong oval, with numerous longitudinal wavy ridges. On the top is a small nipple. The base is nearly smooth and is somewhat flattened. The egg becomes somewhat narrower towards the top, and is of a pale yellow color, assuming a slaty gray as the young larva within develops. Height, 1 mm.; width, .75 mm.

Young Larva.—Head dirty greenish white. Body above mouse colored. Last segment with a fork-like process. Underside dull greenish gray. Length, 2 mm.

I did not succeed in rearing this insect beyond this stage.

Apatelodes torrefacta *A. & S.*

Egg.—Smooth, lenticular, semitransluscent, shining, rounded in outline and very much flattened above and below. Width, 2 mm.; height, .5 mm. Laid June 24. Larva emerged July 5. Received from Miss Emily Morton.

Young Larva.—Yellowish white, with long flossy, white hairs covering the body. Head white, with a black spot on the anterior part of each side. Length, 3 mm. Moulted July 10.

After First Moult.—Little difference from the previous stage, except that the underside is now somewhat greenish, and the hairs are distinctly longer, with a single black pencil or tuft on the eleventh segment. Length, 7 mm. Moulted July 14.

After Second Moult.—In this stage the hairs are considerably longer, clearer white and more flossy. Mouth parts pitchy black. Along the dorsum is now a faint black longitudinal stripe, and a few black hairs of the same color are on the second and third segments. Length, 11 mm. Moulted July 18.

After Third Moult.—The hairs are still longer than in the previous moult, and the black pencil on the eleventh segment more distinct. The hair on the three anterior segments are longer than those of the posterior segments. The black dorsal line is also more distinct and is broken. The underside of the body is semitransluscent, showing the greenish contents. Length, 20 mm. Moulted July 23.

After Fourth Moult.—The hairs in this stage are pure white and are directed backwards. On the dorsum of each of the second and third segments is a long black pencil, and one on the eleventh segment. Along the dorsum is a narrow black line as in the previous stage, and a bunch of short hairs of the same color on each segment, dorsally. The body color is now of a bluish-white, and the spiracles are black. Body on the underside with a short transverse black patch on each segment. Some individuals of the brood are now yellowish in color. Length, 30 mm. Moulted July 27.

After Fifth Moult.—Head dirty white. A row of rather large spots on each side of the body, one spot on each segment. The dorsal stripe is much broader and more prominent than in the previous moult, and the three dorsal pencils are mouse color instead of black, and are tipped with white at the extreme ends. The abdominal legs are black, with their extremities pinkish. The thoracic feet are also black. The hairs are all directed backwards, except those on the anterior segment, which are directed forwards. Mouth parts pitchy black. The short tufts of black hairs along the dorsum are also present. When fully grown the body is creamy white or pale yellow, with the black spots along the sides and dorsum quite conspicuous. The hairs in the yellow-bodied larvæ are pale yellow, and in the whitish-bodied ones the hairs are pure white. In some yellow-bodied larvæ which I found outdoors the hairs were bright sulphur yellow. When fully grown the extremities of the abdominal legs are much redder than immediately after moulting. Length, about 45 mm.

Entered the ground August 2, at 10 A. M. Pupated August 4, at 4 P. M. Emerged August 27, 28 and 29.

My brood of larvæ were raised on Wild Cherry (*Prunus serotina*). It also feeds on Willow, Alder, Blackberry, Bayberry (*Myrica cerifera*), Azalea, Sassafras and Hazel.

Sisyrosea inornata *G. & R.*

Full-grown Larva.—Bright yellowish green ; the body much flattened at the sides, the segments there being ornamented with flattened processes armed with spines and looking like the antennæ of a Bombyx. These spinuous processes are nine on each side. The head is quite hidden by the overlapping of the other segment. It is smooth, pitchy. The second segment is darker green than the rest of the body. The third and fourth have shorter spines on the sides, and these are edged with orange speckled with black. The dorsum is elevated into a double ridge, pale cream color. On the eighth and tenth segments is a small orange mark in form of a maltese cross. The ridges over the head are produced into a short spine, orange, flecked with black. The spiracles are pale yellow, and on each segment there are six small fovea, which on the sides are continued by pale green waved lines, those on the dorsum the smallest. Underside pale green. Length, about 15 mm.; width, 10 mm. (including spines).

Food-plants.—Oak, Cherry, Hickory.

Anisota stigma *Abb. & Sm.* (var. or nov. sp.).

Before Last Moult.—The ground color is jet black and shining, becoming greenish or tea colored as it is more advanced towards the last moult. The whole of the tubercular spots, as well as the spines and longer processes, are also jet black. The white irrorations, so well marked in *A. stigma*, is entirely wanting, and there are no marks on the obsolete, double, broken, subdorsal sordid white line. Length, 30 mm.

Full-grown Larva.—The head is now brick red. The obsolete broken subdorsal line is a little more distinct, and is treble instead of double. The body has lost its shiny appearance, and is now dull black. The irrorations are jet black, shiny, save that on each segment is a double row of tubercular irrorations, sordid white. There is a dull claret-stained ventral line, broken at the junction of each segment, and the interior surface of the abdominal legs is also stained with a claret shade. They are black outwardly, as are also the thoracic feet. The broken line on the underside is really reduced to three lozenge-shaped dashes on each segment. Laterally the larvæ are stained with red. Length, about 60 mm.

I have been unable to rear this singular larva to maturity. A number of them were taken by me last season at Scarsdale, N. Y. The late Henry Edwards and S. L. Elliot were also acquainted with this larva, and likewise did not succeed in raising it. Mr. Edwards considered it the larva of a new species of *Anisota*. It is certainly very different from all other *Anisota* larva found in the vicinity of New York City.

HYBRID BETWEEN **Actias luna** MALE, AND **Actias selene** FEMALE.

Egg.—Received from Miss Emily Morton. Ovate, smooth, not shining, covered with a brown substance, much the same as that of *A. luna*, in fact I cannot see any difference.

Young Larva.—Pinkish brown, with two rows of deep brown spots on each side, and one row on the dorsum, which are quite indistinct ; on the third segment the spots are largest and deeper in color. The spots along the sides are two in number on each segment, while in the subdorsal row there is only one spot on each segment. The juncture of the segments are greenish in color, as is also the head, which has two transverse, black bands. On each side of the body are three rows of tubercles, bearing a number of long spine-like hairs. The first segment is yellowish, and without spots. Underside of body wholly greenish. Length, 6 mm. Moulted July 2.

After First Moult.—The larvæ are now greenish in color, with the three rows of tubercles on each side yellow, tipped with reddish orange ; the two pairs of dorsal tubercles on the third and fourth segments are decidedly larger than the rest, and are tipped with black. The rows of spots are also less distinct than in the previous stage, and the head lacks the transverse bands, and is of the same color as the body, with a small black dot on the anterior part of each side. Each of the tubercles has a few, rather long, brown hairs. Underside greenish. Thoracic feet jet black. Abdominal and anal legs tipped with black. One individual of the brood is flesh colored, and has the extremities of the tubercles black, and the lateral row of spots more distinct than the two other rows. Length, 15 mm. Moulted July 6.

After Second Moult.—The body is now bright green, with a narrow, paler green line below the spiracles, which are orange. The spots are absent in this stage, and the tubercles more prominent with a few black hairs, and tipped with orange. The anal plates are half brown and half black, and are narrowly bordered with green. Head pale green, mouth parts pitchy. Thoracic feet black. Abdominal legs green, with a black patch on the outer side of each. Underside wholly green. Length, 25 mm. Moulted July 11.

After Third Moult.—No difference from the previous stage, except in size, and in the tubercles being somewhat brighter in color. Length, 35 mm. Moulted July 15.

After Fourth Moult.—The head in some individuals is now purplish green instead of wholly green, as in the foregoing stage. The tubercles are also more prominent. Length, 40 mm. Moulted July 19.

After Fifth Moult.—The head in this stage is pale chestnut brown, as are also the thoracic feet, with a yellow ring at their bases. The anterior edge of the first segment is yellow. The anal plates are brown with a yellow margin. The spiracles are large and orange in color. The abdominal legs have a black band on the outerside of each. The two rows of tubercles along the sides are smaller than those on the dorsal region, as is the case throughout all the previous stages. The segments are much swollen, and deeply incised at junctures. The yellow line below the spiracles runs from the beginning of the fourth segment to the end of the eleventh. The hairs on the yellow tubercles are pale brown, while those on the row of tubercles below the spiracles are black. One example has the bases of the tubercles on the third and fourth segments blackish. Fully grown July 31. Length, 65 mm.

Euchromia bella *Guer.*

Cocoon.—Oval, bright lemon yellow in color ; very thin and composed of finely woven silk, which is intermixed with the larval hairs, also of lemon-yellow color. These hairs penetrate through the cocoon, thus giving it a decidedly wooly appearance. Length, 15 mm. ; width, 8 mm.

One example, collected by Mr. Wm. Schaus, in Jalapa, Mexico. Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Euchætes fumidus *Hy. Edwards.*

Cocoon.—Oval, very frail in structure, and composed of dark brown threads amongst which are mingled the larval hairs. Very much like that of *Euchætes egle* Dr., and hardly distinguishable from it. Length, about 18 mm. ; width, about 8 mm.

One specimen, collected by Wm. Schaus, in Jalapa, Mexico. Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Pericopis leucophæa *Walker.*

Pupa.—Color, bronzy brown, with a slight bluish reflection on the thorax, if held in certain light. Thorax and anterior portions of the abdominal segments above, opaque. The posterior portions of the segments beneath, as well as the wing-cases, are shiny. A few very short reddish brown hairs are also scattered over the segments above. The first to fourth segments are decidedly elevated dorsally, and the remaining segments gradually decreasing in size toward the posterior end of the body, which is bluntly rounded. Length, 22 mm. ; width, about 7 mm.

Two examples, collected by Wm. Schaus, in Jalapa, Mexico. Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Callosoma calleta *Westwood.*

Cocoon.—Ovate, base abruptly rounded and gradually becoming narrower towards the end from which the imago makes its escape.

The outer cocoon is finely woven, very compact and cemented together with a glutinous substance, which makes the texture very tough and hard, giving the cocoon a rather smooth appearance. Inside the cocoon is entirely covered with the glutinous substance, except about one-third from the orifice, from where it consists of a coarse brown silk loosely woven and drawn together, so that the imago can readily escape. At one side at this end of the cocoon is a short band, by means of which it hangs to the twig. Length, about 45 mm.; width near base, about 18 mm.; width near top, about 10 mm.

Four specimens, collected by Wm. Schaus, in Jalapa, Mexico. Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Platysamia orizaba *Westwood.*

Cocoon.—Similar to that of *Callosoma calleta*, but may be distinguished from it by being more regular in outline, and the lower end of cocoon bluntly rounded, but not so abruptly as in *C. calleta*. The sides are almost parallel, being only slightly rounded. The meshes of the outer coating are more loosely woven, and are not cemented together with the glutinous substance. In color the cocoon is dirty silvery white or pale golden brown. It is also fastened to the twig by a short band. Length, 45 mm.; width, 20 mm.

Four examples, collected by Mr. Wm. Schaus, in Jalapa, Mexico. Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Gortyna nitela *Guen.*

Egg.—Bluish or greenish white, changing to cream color before exclusion; deposited in the axil of upper leaves. The young larva on being hatched, bores into the stalk, and eats upwards. On reaching the top of the stalk, it feeds upon the young and tender leaves; when these are destroyed it descends again into the stalk and eats downwards. Sometimes the stalk swells from the disorder of its juices, through the punctation, and the young larva is often killed.

Larva before Last Moult.—Head, shining, very pale chestnut color, with the second segment of the same shade, and a black lateral stripe which is common to both. On the side of the second segment, below the black line, is a broad streak of clear white, which encloses the black spiracles. The third segment is purplish brown. One dorsal and two subdorsal stripes of clear white. The fourth, fifth, sixth and seventh segments are wholly purplish black, and are elevated by the caterpillar when walking. The remainder of the segments are purplish brown, with the dorsal and subdorsal white stripes as before. Beneath, the posterior and anterior segments are sordid white. The middle ones purplish brown. Feet blackish. Abdominal legs sordid white.

Full-grown Larva.—The posterior segment is now a little paler in ground color, and the head and anal segment yellowish. Length, 30 mm. Bores in the stalks of Burdock and a variety of other plants.

Gortyna cataphracta *Grote.*

Full-grown Larva.—Head and second segment pale testaceous. Mouth parts pitchy. Body color purplish brown with dorsal whitish stripes continued throughout the whole length. On side of head and second segment is a black shining line. On the third and fourth segments are three warty black tubercles on each side, six smaller ones on the third, and four on the fourth, dorsally. The other segments have two large and two small tubercles dorsally, and three smaller ones laterally. All the tubercles look like points of tar or pitch. Anal segment pale testaceous, black at sides. Thoracic feet black. Abdominal legs whitish. There are also a few sordid white hairs scattered over the whole of the body. Length, 30 mm. Bores in the stalks of Lily (*Lilium superbum*).

Article IX.—ON THE DIVISIONS OF THE WHITE RIVER OR LOWER MIOCENE OF DAKOTA.

By J. L. Wortman, M.D.

The palæontological expedition from the American Museum of Natural History into the Miocene deposits of Dakota during the past summer was exceedingly fortunate in bringing to light a comparatively new fauna for this horizon. Notwithstanding the fact that these localities have been collected over for the past fifty years, and have yielded perhaps a greater number of individual specimens of fossil mammals than almost any other in North America, it has never apparently been suspected that the uppermost strata of this deposit contain a fauna, in many respects different from those of the middle and lower divisions.

Fossils have undoubtedly been collected in these upper beds and are not unknown in the rich collections from this horizon in our various museums, but no systematic attempt has to my knowledge ever been made to point out their more exact faunal characters. Especial attention was given to this part of the subject during our exploration of these bad-lands, and each specimen was carefully marked with reference to its exact position in the sedimentary mass. From these data I have found it possible to construct a catalogue of our collections showing the more important facts relating to the succession of genera and species during the time that this sediment was being laid down. The very considerable thickness of the deposit indicates of itself a long period of time, and it is not at all unnatural to suppose that important changes in the evolution of genera and species should have taken place, and be indicated by the fossils from the different levels of the sediment. That such is the case I will attempt to show in this present communication. Before passing to a discussion of this important problem, however, I will notice briefly the physical characters of the sediments themselves together with their divisions.

That part of the White River deposits to which our attention was especially directed is that which forms the main divide between the White and Cheyenne Rivers in South Dakota in the vicinity of the Black Hills. This is the thickest portion of the White River sediment with which I am acquainted, and it is probable that it represents somewhere near the entire thickness of the accumulation which took place in the Miocene lake. Although no accurate measurements were taken its vertical depth was estimated to be about 800 feet. In this region it rests upon the black shale (Cretaceous No. 4), and in many places has been cut through by the streams, so that a complete section is exposed.

I.—DESCRIPTION OF THE SEDIMENT AND ITS MAIN DIVISIONS.

Heretofore there have been two main divisions recognized in the classification of the White River sediments, viz.: a lower division, under the name of the *Titanotherium Beds*, and an upper division, known as the *Oreodon Beds*. This latter division was made to include all those strata lying above the Titanotherium Beds, and was estimated at somewhere in the vicinity of 600 feet in thickness. I now propose a third primary division, which will include the uppermost strata of the Oreodon Beds of other authors. This division may be called the *Protoceras Beds*, from the relative abundance of this characteristic fossil. As in the other two divisions, the separation is made largely upon the faunal characters which will be discussed later on.

THE TITANOTHERIUM BEDS.

This division of the Miocene has recently formed the subject of a very exhaustive and excellent article by Mr. J. B. Hatcher,[1] and what is here said upon this topic is drawn largely from his statements. The beds are composed of clays, sandstones and conglomerates ; the clays greatly predominate. Near the bottom of the beds the color is often red or variegated, but the prevailing color is a very characteristic and delicate greenish white. The sandstones are never entirely continuous, and never more than a few feet in thickness. They present every degree of compactness, from beds of loose sand to the most solid sandstones. The conglomerates are very similar in character, with the exception that they are usually harder.

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[1] The Titanotherium Beds. American Naturalist, March, 1893.

By actual measurements, Mr. Hatcher found the Titanotherium Beds in this locality to present a total thickness of 180 feet. Of this the first 50 feet constitutes the lower division, the next 100 feet the middle division, and the remaining 30 feet the upper division. These divisions are made upon the characteristic forms of Titanotheriidæ found in each layer. This is well shown in the accompanying table which is taken from Mr. Hatcher's article.

The fauna of the Titanotherium Beds is very limited, so far as the variety of forms is concerned. While the remains of the Titanotheriidæ are relatively very numerous other genera are but very sparsely represented by the merest fragments. The only remains other than *Titanotherium* which I could identify with any degree of certainty were those of a small *Aceratherium*, a species of *Hyopotamus*, and probably of *Elotherium mortoni* and *Mesohippus*. With the exception of the *Hyopotamus* none of these remains were found in place, but I am inclined to the opinion that these genera will yet be found well down in the Titanotherium Beds. At the point where the Titanotherium Beds pass into the overlying Oreodon Beds, mingled remains of *Titanotherium*, *Aceratherium*, *Mesohippus*, and *Elotherium mortoni* occur; and it is a matter of the greatest interest to note that the *Aceratherium* here found is not only the oldest but the most primitive member of the true rhinoceroses which has been found in this country. Our collection contains two fairly good specimens from this layer, and they are sufficiently well preserved to fully make out the characters of the dentition. I will again refer to this subject later on.

THE OREODON BEDS.

The changes which led up to and caused the extinction of the gigantic Titanotheriidæ also witnessed a remarkable transformation in the fauna on the shores of the White River lake, for no sooner do we pass from the Titanotherium Beds into the Oreodon

STRATIGRAPHIC TABLE OF WHITE RIVER MIOCENE.

Approximate estimate of the thickness of the Beds.	Characteristic Species and General Character of Rock.	Genera obtained by Expedition of 1892. The numbers are those of the Museum Catalogue.
PROTOCERAS BEDS. 100 feet.	Leptauchenia Layer: nodule-bearing, pink-colored clays widely distributed.	Eucrotaphus (Eporeodon), 612–619. Leptauchenia, 620–629.
50–75 feet.	Coarse sandstones occupying different levels, not continuous.	Protoceras, 639–646. Pogonodon (?), 656. Artionyx, 685. Protapirus, 659, 661–663. Elotherium, 573, 574. Hyopotamus, 580–584, 590, 592. Anchitherium, 678–683. Hyracodon, 560. Hyopotamus, 585–589, 591, 593. Aceratherium, 538–545, 564.
BARREN CLAYS. 100 feet.	Light-colored clays.	
OREODON BEDS. 75 to 100 feet.	Nodulous clay stratum. Bones white.	Oreodon, 611. Poëbrotherium, 638. Hyænodon, 648. Metamynodon, 548, 696. Aceratherium, 537. Elotherium, 572. Hyopotamus, 578, 579.
	Sandstones and clays. Bones rusty colored.	Aceratherium, 533, 534, 535 (?), 536. Mesohippus (?), 684.
10 to 20 feet.	Oreodon Layer: nodule-bearing, very constant and widely distributed. Numerous Oreodons and turtles imbedded in nodules. Bones always covered with scale of ferruginous oxide. 'Red layer' of collectors.	Aceratherium, 525, 526, 529–532, 561–563. Hyracodon, 556–559. Mesohippus, 664–668, 671–677. Elotherium, 566–570. Hyopotamus, 577. Oreodon, 594, 595–610, 657. Poëbrotherium, 630–637. Hyænodon, 647, 649. Hoplophoneus, 650, 651–655. Leptomeryx, 686–688. Leptictis, 689–691. Ischyromys, 692–694.

OREODON BEDS. (*Continued.*) 50 feet.	Metamynodon Layer: sandstones, sometimes replaced by light-colored barren clays. Bones usually rusty colored.	Aceratherium, 524, 527. Metamynodon, 546, 547, 549–555. Mesohippus. Protapirus, 660. Colodon, 658. Elotherium, 571. Hyopotamus, 575, 576.
	Reddish gritty clay, sometimes bluish. Bones white.	Aceratherium, 521, 522, 704. Mesohippus, 669, 670.
	Mingled remains of Titanotherium, Aceratherium, Mesohippus.	Aceratherium, 523, 528. Mesohippus, 544. Elotherium mortoni and Hyopotamus.
TITANOTHERIUM BEDS. (Total thickness, 180 feet.) Upper Beds, 30 feet.	Clays, sandstones and conglomerates.	Titanotherium. Elotherium (?), 565. *Titanotherium* of large size. Horns 10–18 in. long, elliptical to sub-ovate in cross-section. Nasals very short and pointed. Incisors never more than 2. Internal cingulum on upper premolars not strongly marked in either sex. Posterior inner cone on last upper molar. Third trochanter present. Trapezium absent.
Middle Beds, 100 feet.	Clays, towards the base often reddish, or variegated. The prevailing color, however, is a delicate greenish white. Bones are always light colored or white, sometimes rusty.	Titanotherium, Aceratherium (?), Hyopotamus, Elotherium (?), Mesohippus (?), Trionyx. *Titanotherium* of medium size. Horns 4–10 in. long, circular to sub-triangular in cross-section. Nasals of moderate length, with broad or pointed extremities. Incisors never more than 2. *Strong* internal cingulum on upper premolars of males only. Posterior inner cone on last upper molar. Third trochanter present. Trapezium absent.
Lower Beds, 50 feet.		Titanotherium. *Titanotherium* of small size. Horns rudimentary or from 1–4 in. long, circular in cross-section. Nasals long and pointed. Incisors occasionally as many as 3. *Strong* internal cingulum on upper premolars in males only. No posterior inner cone on last upper molar. Third trochanter somewhat rudimentary. Trapezium present in earliest forms.

Beds than we find the remains of a fauna remarkable alike for its richness and variety. Just what caused this change I am at a loss to even conjecture. The dividing line between these two primary divisions of the White River sediment is sharply indicated, not only by the extinction of the Titanotheriidæ, but by the introduction of the variety of forms which followed with little or no previous announcement in the underlying strata.

Like the Titanotherium division the Oreodon Beds are composed of sandstones and clays, of which the latter largely predominate. These strata are seldom continuous over a wide area. They change not only in color but in the materials of which the sediment is composed sometimes with considerable abruptness. In some places the Titanotherium Beds are overlaid by a reddish gritty clay, while in others it is light or buff-colored clay, which may be interrupted by layers of sandstone. There is one layer found in the Oreodon Beds which is highly characteristic and is perhaps more constant and widely distributed than any other single stratum in the whole White River formation. This is a buff-colored clay carrying numerous calcareous nodules in which are imbedded remains of turtles and oreodons. The fossils are almost invariably covered with a scale of ferruginous oxide when first removed from the matrix, and are of a decidedly reddish cast. Upon this account this stratum is known to the collector as the 'red layer.' It is situated somewhere between 40 and 50 feet above the top of the Titanotherium Beds and can almost always be easily identified. It varies in thickness from 10 to 20 feet, and in some rare instances it is replaced by sandstone. I have also found it without the nodules in places, but this is also quite a rare occurrence.

In the particular region examined by us there is a very considerable belt of sandstone found just below the Oreodon or red layer just described. It has an average thickness of about 20 feet, and as nearly as could be determined covers an area of 12 miles in length by a mile or a mile and a half in width. I mention this belt of sandstone in particular for the reason that it has with a single exception produced the only remains of *Metamynodon* so far known. Upon either side it is replaced by a bluish or light-colored clay which appears to be entirely barren of vertebrate remains. Between this Metamynodon layer and the top of the Titanotherium Beds is found the reddish-colored gritty clay already mentioned. It has a thickness of about 25 feet and contains numerous remains of *Aceratherium*, *Mesohippus*, *Elotherium*, *Oreodon*, *Hyopotamus*, and in fact nearly all the genera which are found in the Oreodon Beds proper.

The character of the strata overlying the typical nodule-bearing Oreodon layer is very various in different parts of the bed. Sometimes it is a moderately thick bluish-colored standstone containing numerous remains of *Aceratherium*, but more frequently it is a light-colored clay containing few fossils. In one stratum of this sandstone we obtained the remains of a *Metamynodon* at the highest point in which it has been known to occur. At a distance of from 75 to 100 feet above the Oreodon layer there is a second distinct and tolerably constant nodule-bearing layer from which we obtained *Oreodon*, *Poëbrotherium* and *Hyænodon crucians*. This appears to be the uppermost limit of the fossil-bearing Oreodon Beds, so far at least as this region is concerned, and it is at this point, therefore, that I draw the line between the middle primary division (Oreodon Beds) and the uppermost division, Protoceras Beds. If it is desirable to subdivide the Oreodon Beds I would suggest that all those strata between the top of the Titanotherium Beds and the typical Oreodon layer would constitute the first division, the Oreodon layer itself would form a second division, and all those strata above the Oreodon layer, between it and the Protoceras Beds, would constitute the third division.

PROTOCERAS BEDS.

Between what I have taken to represent the uppermost limit of the Oreodon Beds and the Protoceras Beds there is a very considerable thickness of light-colored clay in which very few fossils occur. These strata reach a thickness of 100 feet or more, and upon this account it is easy to distinguish, in this region at least, between the Oreodon and Protoceras Beds. In other localities, however, these clays may yet be found to be fossiliferous, in which event the line of demarkation between these two divisions will be found to be much less distinct, and their separation accomplished with much more difficulty. They are in many places capped by isolated patches of coarse sandstone which occupy different levels. They are almost always highly fossiliferous, and it was mostly in them that our collections from this horizon were obtained. These sandstone ledges are seldom continuous for any great distance, and often change abruptly into a fine-grained clay, which, according to our experience, is almost always barren. Immediately overlying the sandstones comes a tolerably constant, pinkish-colored, nodule-bearing clay, in which numerous remains of *Eporeodon* (*Eucrotaphus*) and *Leptauchenia* occur. The thickness of sediment above this is somewhat difficult to determine, but judging from the highest points in the vicinity it cannot be less than 75 or 100 feet. The strata, therefore, which constitute the Protoceras Beds are the sandstones, the nodule-bearing layer and its capping. The entire thickness of these beds is estimated at 150 feet.

II.—Faunal Distribution and Succession of Types.

Faunal Distribution.

1. *Titanotherium Beds.*—The Titanotherium Beds contain *Titanotherium* with its several forms, *Aceratherium*, *Hyopotamus*, *Elotherium* (?), *Mesohippus* (?). We also discovered fragmentary remains of turtles of the genera *Emys* and *Trionyx*. This latter genus is apparently new to this formation, since it has been supposed that they disappeared from the interior lakes at the close of the Eocene.

2. *Oreodon Beds.*—The Oreodon Beds contain the following genera: *Oreodon*, *Agriochœrus*, *Poëbrotherium*, *Leptomeryx*, *Hyopotamus*, *Elotherium*, *Thinohyus*, *Aceratherium*, *Hyracodon*, *Mesohippus*, *Colodon*, *Protapirus*, *Metamynodon*, *Hyænodon*, *Dinictis*, *Hoplophoneus*, *Daphænus*, *Leptictis*, *Ictops*, *Mesodectis*, *Ischyromys*, *Paleolagus*.

3. *Protoceras Beds.*—In the Protoceras Beds are *Protoceras*, *Eporeodon* (*Eucrotaphus*), *Leptauchenia*, Cameloids, *Hyopotamus*,

Elotherium, Peccaries, *Aceratherium*, *Hyracodon*, *Protapirus*, *Pogonodon* (*?*), *Artionyx*, Rodents, Primates.

SUCCESSION OF TYPES.

I will now take up the question of the change in form and structure, to be noted among the more characteristic genera as we pass from the lower to the upper beds. With reference to the Titanotheriidæ, Mr. Hatcher has shown that important modifications took place, amounting in some instances to changes of true generic significance, between the first appearance in the lowermost beds and the time of the extinction of these forms. The rhinoceros line furnishes equally striking examples of these modifications. From the very lowermost part of the Oreodon Beds we obtained two specimens of *Aceratherium* (Nos. 523, 528), which are the smallest and most primitive in structure of any members of the genus. This is especially noticeable in the character of the fourth superior premolar, which is essentially tritubercular. With both specimens there is also associated a tooth which I take to be a rudimental superior canine. The front of the skull in both instances is so damaged, however, that this is not certain. From the succeeding layer, within a vertical range of twenty-five feet, we have three other specimens of skulls, two of which are in a good state of preservation. In one of these specimens the milk dentition is preserved, and it is a matter of the greatest interest to note that in this specimen we find a well developed and functional superior canine present. In the other skull the dentition shows the animal to have been adult and only the remains of the alveoli of the canines are to be seen. In the third specimen the last molar was just coming into place, and the canine is present. I think, therefore, that it can be safely assumed that these small forms of *Aceratherium*, which are found below the typical nodular layer of the Oreodon Beds, possessed a more or less *persistent superior canine*. In the fourth upper premolar of the three last-mentioned specimens the hypocone or posterior internal tubercle is in the first stages of development, and shows a considerable advance over the two specimens from the lowermost strata, in which it is entirely absent. The foot structure of these small forms from this horizon is unknown, but some light is thrown upon this question by two specimens from the typical nodular layer. In these specimens the manus is provided with four digits,[1] and I am strongly inclined to the opinion that all the species of *Aceratherium* in the Oreodon Beds possessed four well-developed toes upon the front feet.

The next important change in this genus is met with in the specimens from the strata of the Oreodon Beds lying above the typical nodular layer. In them we note that the superior canine has *completely disappeared* from the milk dentition, as is shown by a very perfect and well-preserved skull in this stage. It is also to be remarked that the fourth superior premolar is now fully quadritubercular and that there is a tendency, especially in those from the uppermost of these strata, for the post-glenoid and post-tympanic processes to become approximated below so as to enclose the external auditory meatus. The species have also become considerably larger, and there is some evidence that the superior lateral incisors were becoming somewhat reduced in size.

The final stage in this development of *Aceratherium* is met with in the large species from the Protoceras Beds. Fortunately we have an unusually perfect skeleton of this form. Its size is almost double that of the small species from the base of the Oreodon Beds. The manus is provided with only three digits, the lateral incisors of the upper jaw are much reduced, almost rudimental it may be said, the external auditory meatus is completely enclosed by the post-tympanic and post-glenoid processes, and the fourth superior premolar is fully molariform.

In the horse series we have *Mesohippus* from the lower Oreodon Beds, but when the Protoceras Beds are reached *Anchitherium* appears. Now the most important generic distinction between these two genera is to be found in the circumstance that *Mesohippus* has a rudiment of digit V in the manus while *Anchitherium* is without it. This character is associated with other important modifications of the teeth. It can thus be plainly demonstrated that one is the outgrowth of the other. Again in a species of *Protapirus* from the Oreodon Beds the superior premolars are all tritubercular, while in the Protoceras Beds a species is met with in which there is a marked tendency for the fourth tubercle to appear.

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[1] In the Princeton collection there is a carpus of *Aceratherium mite* which both Professors Osborn and Scott believe had only three toes. In the absence of the metacarpals this is very difficult to decide, as one can readily appreciate by reference to the tapir or any four-toed form. In both the tapir and the foot of our specimen just referred to there is but a *single* distal facet upon the unciform, and with only this bone to guide us it would be very difficult if not impossible to tell whether the specimen under consideration was a three or four-toed form.

Among the Oreodons all the skulls from the typical nodular layer are without an inflated tympanic bulla. In the uppermost strata of the Oreodon Beds there is one skull in the collection which has a very small bulla, while in the nodular layer of the Protoceras Beds all the skulls show a well-developed bulla.

These instances could undoubtedly be multiplied if collections were made with this object in view, but I deem the examples already given sufficient to establish the main proposition advanced, namely, that the Lower Miocene or White River of America represents a great period of time in which the Titanotheriidæ, Rhinocerotidæ, Equidæ and Oreodontidæ underwent a very marked series of changes. The topmost, or Protoceras Beds, may very possible prove to overlap the John Day or Middle Miocene of Oregon.

Article X. — ON A COLLECTION OF BIRDS FROM CHAPADA, MATTO GROSSO, BRAZIL, MADE BY MR. H. H. SMITH.

By JOEL ASAPH ALLEN.

PART III.—PIPRIDÆ TO RHEIDÆ.

(*Concluded from Vol. IV, p.* 350.)

133. Metopia galeata (*Licht.*).—This species is evidently abundant and resident at Chapada throughout the year. It is represented in the collection by a series of 127 specimens, taken as follows: January, 4; February, 8; March, 6; April, 11; May, 8; June, 13; July, 15; August, 9; September, 31; October, 11; November, 6; December, 5. The adult males number 45, and some were taken in each month; the young males in transition dress number 24, some of which were taken in each month except March and July; 15 are young males nearly in the dress of the female, of which none were taken from October to January, inclusive; the remaining 43 are females, and include specimens taken in every month except January.

The September and October specimens may be considered as representing the dress of the breeding season, and as such will be made the standard of comparison for those of other seasons. The adult males are everywhere deep lustrous velvety black with a bluish tinge, except on the interscapulars, back of the neck, cap and frontal crest, which parts are intense lustrous scarlet. The scarlet feathers, however, are pure white at base, and the white basal portion is separated from the scarlet apical portion by a narrow band of deep yellow. The adult females are nearly everywhere deep green, somewhat lighter, or more yellowish green, below. A few specimens, sexed by the collector as females, have a faint reddish shade over the portion colored scarlet in the adult male, and are of a brighter or more golden green below. These occur at all seasons, and are, I suspect, really young males of the year, since they pass into a stage in which this phase of plumage is more or less mixed with scattered red feathers on the head and back and with black feathers on the throat and breast.

Young males present every transition between these last and males in which the black of the body is more or less mixed with green, while the red is perfectly developed. A large proportion of the young males, however, are in a patchy, transition stage, in which the red of the upper parts varies from nearly the full amount to merely a few perfect glossy scarlet feathers (differing in structure from the green feathers), scattered among the interscapulars and over the nape and cap, with more or less black over the basal portion of the quills and greater wing-coverts, and numerous black feathers scattered through the green clothing plumage of the body. Some show considerable admixture of black with little or no red; others more red and less black.

This patchy condition seems to have no relation to season, as every stage is found throughout the year; it is, however, evidently due to age, as doubtless the male does not acquire perfect dress till at least the third year. The only specimens which give clear evidence of being in molt when taken are a few collected in November, December, January and February.

It is of interest to observe that the amount of black at the base of the quills of the tail and wings, and on the greater wing-coverts and on the upper tail-coverts, varies with the amount of black and red in the body plumage. In what seems to be the second stage, or second year, the wing quills and rectrices are green, or blackish merely at the base; in the next stage the tail-feathers are all black for their basal half, and some of them black or blackish for their whole length on the inner vane, and some of the middle lateral ones almost wholly so on both vanes. At this stage the peculiar glossy red feathers have become usually more or less prevalent. With the increase in the amount of black on the remiges and rectrices the greater coverts come out black, either all or in part; sometimes only one or two are black and the rest green, or the greater part may be black and the others green.

The appearance of some of the parti-colored black and green rectrices is suggestive of a gradual change of green to black without molt;[1] but that this is not so is shown in molting birds where the partially grown rectrices (the basal portions still in their sheaths) are green apically and black basally, or all black, as the case may be in different feathers, just as in specimens taken months after the completion of the molt.

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[1] That such a change of color does occur, in cases perfectly parallel with the present, has been stated of late in several quarters, to be either a fact or a highly probable supposition; it is hence desirable to call special attention to the matter in this connection. (*Cf.* Keeler, Evol. of Colors in N. Am. Birds, 1893, p. 134. Dr. L. B. Bishop advocated the same theory in reference to the European Kestrel before the Linnæan Society of New York at its meeting of April 5, 1893.)

In birds that require several years for the acquisition of the adult breeding dress, the various transition stages present usually various degrees of combination of adult and juvenile tints, resulting in many singular effects, not only as regards the plumage as a whole, but as regards the appearance of individual feathers. Sometimes individual feathers present intermediate phases of coloration between the earlier and the final stages ; or at one, or even two molts before the final stage is reached, feathers like those of the adult dress become prematurely developed, as in the case of the present species.

134. **Pipra fasciata** *d'Orb. & Lafr.* — The series of 51 specimens consists of 28 adult males, 19 adult females, and 4 young males, nearly in the dress of the female, with slight traces of red feathers coming in. Each month of the year is represented except September and December, as follows : January, 1 ; February, 5 ; March, 11, of which 10 are adult males ; April, 7, of which 4 are adult females ; May, 4 ; June, 3, all females ; July, 4 ; August, 4, of which 3 are males ; September, 0 ; October, 2 ; November, 10, of which 8 are males ; December, 0.

135. **Heteropelma flavicapillum** *Scl.*—The series of 65 specimens represents every month of the year, and the two sexes are about equally represented.

The coloration is remarkably constant at all seasons, the only very appreciable difference being in respect to the crest, which is much more developed and much brighter in color in the males than in the females. It doubtless varies somewhat with age, as many specimens sexed as males have the crest scantily developed and dull greenish yellow instead of deep lustrous golden as in the adult males.

This series should represent the *Heteropelma chrysocephalum* Pelzeln, in which case I am unable to distinguish it from *H. flavicapillum* of the Brazilian coast. I have, however, for comparison only two Bahia specimens, and a larger series might show slight average differences at present inappreciable.

136. **Tityra cayana brasiliensis** (*Sw.*).—A single female, taken at Chapada in September, 1882.

137. **Tityra personata semifasciata** (*Spix*). — Chapada, 8 specimens, Sept.–Nov., 1882, and Jan.–Feb., 1883.

138. **Tityra inquisitor** (*Licht.*).—Corumba, Feb. 26, 1886, ♂ ad.; Chapada, ♂ ad., May 16, 1885, and ♂ juv., Sept. 1, 1885.

139. **Hadrostomus atricapillus** (*Vieill.*).—The 13 specimens of this species were collected as follows; January, 2 females; February, 2 males; July, 1 male; September, 1 male; October, 1 female; November, 3 males and 2 females; December, 1 female. This shows that the species is present at Chapada from September till February, and that it may occur in other months.

140. **Pachyrhamphus viridis** (*Vieill.*). — Represented by a single specimen, ♂ ad., taken at Corumba, March 18, 1886.

141. **Pachyrhamphus polychropterus** (*Vieill.*). — Chapada, 4 specimens, as follows: ♂ ad., Aug. 16; ♂ juv., May 4; 2 females, March 14 and April 17.

142. **Pachyrhamphus atricapillus** (*Gm.*).—Chapada, one specimen, ♂ ad., May 23.

143. **Attila validus** *Pelzeln.*—One specimen, ♂ ad., Nov. 11, 1882. Marked "Rare" on the label.

This seems to agree very well with the description of *A. validus* by Pelzeln (Orn. Bras., p. 95) and Sclater (Cat. Bds. Brit. Mus., XIV, p. 364), except that the cap is apparently of a darker, more dusky gray—a feature, however, which is variable in other gray-capped species of the group.

144. **Geobates pœcilopterus** (*Wied*).—Five specimens, January, July and September.

145. **Casiornis rubra** (*Vieill.*).—The series of 23 specimens indicates that the species is present, but probably not abundant, at Chapada throughout the year. Each month is represented by from one to four specimens, except March, June and October.

There is apparently no very appreciable amount of sexual variation in color. There is, however, some seasonal variation, through fading, as the season advances. In fresh plumage the chestnut color above is a little brighter and more rufous, and the belly is more strongly tinged with yellowish than towards the close of the breeding season.

146. Furnarius albogularis (*Spix*).—The 8 specimens were taken: 1 in March, 2 in April, 1 in May, 1 in June, 1 in July, and 2 in October.

147. Furnarius leucopus *Swain.*—One specimen, ♀ ad., Corumba, April 8, 1882.

148. Lochmias nematura (*Licht.*).—Twelve specimens, taken as follows: January, 1; February, 0; March, 1; April, 0; May, 1; June, 2; July, 1; August, 0; September, 2; October, 1; November, 2; December, 1. It is therefore probably resident throughout the year. The whole series is very uniform in coloration.

149. Synallaxis azaræ *d'Orb.*

Synallaxis azaræ D'ORBIGNY, Ois. 1833-44, p. 246. (Types examined.)—ALLEN, Bull. Am. Mus. Nat. Hist. II, 1889, p. 243.

Synallaxis cinereus WIED, Beitrag. Naturg. Bras. III, ii, 1831, p. 685 (in part. *Cf.* this Bull. II, 1889, p. 243).

Synallaxis frontalis PELZELN, Sitz. d. k. Ak. Wien, XXXIV, 1859, p. 117; *id.* Orn. Bras. i, 1868, p. 35.—SCLATER, Cat. Bds. Br. Mus. XV, 1890, p. 39. And of most recent writers.

In the present series of 36 specimens every month of the year is represented except November, although December and March have each but one. There are several young specimens, partly or wholly in first plumage, the youngest being little more than half-fledged, taken April 20, 1885.

There is apparently no sexual variation in size or coloration among adults. The seasonal variation consists mainly in the amount of silvery white tipping the feathers of the blackish throat patch; in fresh plumage the black is nearly concealed, but becomes prominent as the silvery tips of the feathers wear away. In the same way the frontal band is more or less concealed in fresh plumage by a slight tipping of ferruginous.

The frontal band is ordinarily broad and well defined, but in quite a proportion of the specimens it is much narrowed by the extension forward of the ferruginous cap, which in a number of examples nearly reaches the base of the bill, while in one (No.

33,725, ♀ ad., July 3) it extends entirely to the bill, as in *S. ruficapilla*. That it is not this species is shown by its small size, and especially by the very small size of the bill, and the absence of a yellowish superciliary border to the cap behind the eyes.

There is also considerable variation in the color of the tail among adult birds, there being quite generally a dusky shade on the inner vanes of the middle pair of rectrices, extending sometimes for nearly an inch and covering nearly the whole width of the vane apically; in others there is merely a trace of dusky, or it may be wholly absent.

Young birds in first plumage are very unlike the adults. There is no rufous cap, the whole upper surface being uniform, and of a shade closely approaching that of the back in the adult. The wings and tail are of a dull, somewhat olivaceous brown, and the lower surface is more silky, and a little paler buff on the flanks. The dusky throat patch is clearly traceable below the surface. With the first molt rufous feathers begin to appear on the crown and among the wing-coverts, and the dull brown quills are replaced by the rufous quills of the adult. The buffy white covering of the edge and inside of the wing gives place to the more rusty tint of the mature plumage.

Nests and eggs were taken in October, December and January, and young birds hardly able to fly in April, implying a long breeding period.

150. **Synallaxis scutata** *Scl.*—Seven specimens, as follows: May, 3; June, September, October and November, each 1.

151. **Synallaxis cinnamomea** *Pelzeln.*—Corumba two specimens—♂ ad., March 1, ♀ ad., April 1, 1886.

152. **Synallaxis torquata** *Wied.*—One specimen, ♂ ad., Dec. 5, 1882.

153. **Phacellodomus ruber** (*d'Orb. & Lafr.*).—Corumba, one specimen, ♂ ad., April 7, 1886.—Compared with the type of the species in the Lafresnaye Coll. in the Museum of the Boston Society of Natural History.

154. **Phacellodomus rufifrons** (*Wied*).—Three specimens, Dec. 5, 1883—two adult males and one three-fourths grown

young. The young bird, still in first plumage, does not differ appreciably in coloration from the adults.

Mr. Sclater (Cat. Bds. Brit. Mus., XV, 1890, p. 83) credits a specimen of *P. rufipennis* to the Smith Collection. If there is no mistake as to the source, it was apparently the only specimen of this species in the Chapada Collection—at least none came into the possession of this Museum.[1]

155. **Homorus cristatus** (*Spix*).—Corumba, 2 specimens, Feb. 27 and April 8, 1886.

156. **Philydor rufus** (*Vieill.*).—Each month of the year is represented by a series of 18 specimens, of which 4 were taken in February, 2 in May, and 3 in November, each of the other months being represented by a single specimen.

157. **Xenops rutilus** *Licht.*—A series of 15 specimens represents every month of the year except March and October. Apparently not numerous at any season, the largest number of specimens for any one month being 3, in January. The series is very uniform in coloration.

158. **Sclerurus umbretta** (*Licht.*).—Abrilongo, 1 specimen, ♂ ad., Feb. 8, 1885.

159. Sittasomus chapadensis *Ridgw.*

Sittasomus chapadensis RIDGW. Proc. U. S. Nat. Mus. XIV, 1891, p. 509.
Sittasomus olivaceus SCLATER, Cat. Bds. Brit. Mus. XV, 1890, p. 119, in part; not *S. olivaceus* WIED=*S. erithacus* (LICHT.).

Represented by 18 specimens, taken as follows: January, 2; February, 0; March, 2; April, 2; May, 1; June, 6; July, 2; August, 1; September, 1; October, 2. February, November and December are unrepresented; one third of the whole number were taken in June. The series is very uniform in coloration.

This species is very distinct from *S. erythacus* (Licht.), as pointed out by Mr. Ridgway (l. c.).

160. **Dendrornis d'orbignyanus** *Puch. & Lafr.*—Two specimens, ♂ ad., July 26, 1883, and "♀?" Sept., 1883.

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[1] It may be here stated that Mr. Smith sold to Messrs. Salvin and Godman a considerable number of supposed duplicates before the 'Chapada Collection' (or the principal part of it) was purchased by the Museum.

Identified as this species by Mr. D. G. Elliot (Auk, VII, 1890, p. 183). I had previously determined them to be *D. guttata.* The two specimens differ a little in size, and especially in the color of the bill, which is much yellower in the July specimen than in the other. The plumage is also a little brighter and fresher in this example, as would be expected from the season. While I provisionally adopt this identification, it seems not unlikely that it may be found necessary to refer both *D. d'orbignyanus* and *D. rostripallens* to *D. guttata.* Only a large increase of material will enable one to reach satisfactory conclusions in respect to these difficult birds.

161. Xiphicolaptes major castaneus *Ridgw.*

Xiphicolaptes major castaneus RIDGW. Proc. U. S. Nat. Mus. XII, 1889, p. 16.

Piedra Blanca, Bolivia, ♂, April 20, 1886, in freshly-molted plumage. Type of the subspecies (l. c.).

162. Picolaptes bivittatus (*Licht.*).—Piedra Blanca, Bolivia, ♂, April 21, 1886; Corumba, Matto Grosso, Feb. 4 and 26, 1886; Chapada, January, April, May and December; in all, 12 specimens.

Several of the specimens are stained beneath, apparently from contact with burnt wood. In other respects the coloration is quite uniform, although some of the January and February specimens are in molt. They vary, however, considerably in size, and especially in the length of the bill, as shown by the following measurements of the 12 specimens:

Wing, 3.52–4.00 in., averaging 3.70; tail, 3.20 to 3.63, averaging 3.40; exposed culmen, 1.03 to 1.30, averaging 1.15. There is apparently no sexual variation in size.

163. Xiphorhynchus rufodorsalis *Chapman.*

Xiphorhynchus rufodorsalis CHAPMAN, Bull. Am. Mus. Nat. Hist. II, 1889, p. 160.

Corumba, one specimen, Feb. 26, 1886, type of the species (l. c.).

164. Dendrocolaptes picumnus *Licht.*—Three specimens, July, September and October.

165. Dendrocolaptes pallescens *Pelz.*—Two specimens, Piedra Blanca, Bolivia, April 20 and 23, 1886.

166. Thamnophilus major *Vieill.*—Corumba, Abrilonga, and Chapada—19 specimens, 12 adult males, 1 young male, and 6 adult females, taken as follows: January, 2; February, 5; March, 1; April, 1; August, 2; September, 3; November, 3; December, 2.

167. Thamnophilus ambiguus *Swain.*—This species is represented by 27 adult males and 34 adult females, the number taken during each month ranging from about four to seven, except that only one was taken in December.

The males are very uniform in coloration, the chief variation being obviously due to age, a few of the younger males being slightly tinged, both above and below, with buffy olive, and lacking the white edging on the middle of the central pair of tail feathers—both evidently features of immaturity.

The females are more variable, but the differences appear to be more individual than seasonal. The color below varies from pale buff to strong cinnamon. The cap varies from strong cinnamon to deep chestnut, with a corresponding variation in the depth of color in the brown of the back.

The only other specimen of this species available for comparison is a single male from Bahia, which is very much darker, both above and below, and with less white on the wings and tail, than any of the males in the Chapada series. Should this difference prove constant it would be quite proper to separate the coast and interior forms as well-marked geographical races.

Doubtless *Thamnophilus sticturus* Pelzeln (Orn. Bras., pp. 76 and 144) is referable to *T. ambiguus*, the alleged differences being quite within the range of individual variation shown by the present series.

168. Thamnophilus radiatus (*Vieill.*).—This species is represented by 68 specimens, of which 37 are adult males, 3 young males in transition plumage, and 28 adult females. They were collected as follows: January, 4; February, 3; March, 3; April, 7; May, 2; June, 6; July, 11; August, 13; September, 6;

October, 9; November, 4; December, 0. A set of eggs was taken Oct. 26.

The males in transition plumage were taken Feb. 20, Aug. 17, and Oct. 20. Another somewhat immature male was taken June 28.

The adult males present a wide range of what appears to be purely individual variation, especially in respect to the relative width of the light and dark cross-bars, both above and below. In the darkest specimens the white cross-bars above are about one-fourth to one-third the width of the black interspaces; below the black bars are rather more than half the width of the white interspaces. From this there is an insensible gradation to the other extreme, in which the white and black cross-bars above are about equal, while below the black bars form very narrow black cross-lines, which are more or less obsolete or discontinuous across the middle of the belly. These are winter (June and July) specimens. They grade insensibly into the darker phase. The width of the white tail markings varies coincidently with the varying width of the cross-bars of the general plumage. Several specimens show more or less *white* at the *base of the central crest feathers*—suggesting a close alliance with the *T. doliatus* group.

The females also vary greatly in intensity of coloration, both above and below, the palest females being many shades lighter than the darkest ones.

There is also a considerable range of variation in size, but it does not appear to be distinctly correlated with the variation in coloration, the light birds being sometimes large and sometimes small, and conversely.

The *Thamnophilus radiatus* group has a wide distribution, ranging from Central America to Paraguay. In connection with the large Chapada series I have taken occasion to examine somewhat into the status of its various components, and having had access to the types of *T. albicans* Lafresnaye and *T. nigricristatus* Lawrence, I venture to add a few remarks on the general subject. I am, however, unacquainted with *T. radiatus* Vieill., as restricted by Berlepsch (J. f. O., 1887, p. 17), unless it is represented by the very light specimens in the Chapada series.

Thamnophilus nigricristatus Lawrence is the large, very dark, northern form occurring at Panama; it constitutes one extreme of the series, of which the restricted *T. radiatus* forms the other. *T. nigricristatus* appears to become somewhat lighter and smaller in Colombia, constituting the *T. albicans* of Lafresnaye, the types of which I am unable to distinguish from many of the specimens in the Chapada series. Just how *T. subradiatus* Berlepsch differs from *T. albicans* I am unable to decide, as the name was merely given "for the species from the Upper Amazon," as distinguished from "*T. albicans* from Bogota." Mr. Sclater makes *T. subradiatus* a subspecies of *T. nigricristatus*, but refers to the latter not only Panama specimens but others from Sta. Marta and Bogota; while to his *T. albicans* are referred other Bogota skins. Under *T. subradiatus* are placed not only his Peruvian series, but a pair of birds that originally formed a part of the present Chapada series! *T. capistratus* Lesson (not "Lafresnaye"—*cf.* Rev. Zool., 1840, p. 226), based on a specimen from "Brazil," is kept also apart as a southeast Brazil species. Two Lafresnaye specimens of *T. capistratus* (in Coll. Boston Soc. Nat. Hist.) appear scarcely to differ subspecifically from *albicans*. There is a little less white on the forehead, and there is rather less than the usual amount of white on the tail, yet not less than in many of the Chapada specimens.

In view of the wide range of variation shown by the Chapada series of nearly *thirty* adult males, I may be unduly conservative in estimating the value of the slight differences shown by individual specimens from distantly separated localities. I must, however, for the present refer all of the Chapada series to *T. radiatus*. Part probably represent '*subradiatus*,' and part '*albicans*,' with many 'intermediates.'

In the absence of satisfactory material from other localities for comparison with the Chapada series, it is impossible to reach other than tentative conclusions regarding the forms entitled to recognition in the *T. radiatus* group. The following arrangement expresses my present views in the case:

1. *Thamnophilus radiatus* (*typicus*).—Paraguay and southern Bolivia, and probably the extreme southeastern portion of Brazil.

2. *Thamnophilus radiatus capistratus.* — Eastern and central parts of Brazil.
3. *Thamnophilus radiatus albicans.*—Northern South America, from Peru and northern Bolivia northward.
4. *Thamnophilus radiatus nigricristatus.*—Panama.

I am unable to see how *T. subradiatus* can well be different from *T. albicans.*

At any locality a wide range of variation in coloration will doubtless be found to obtain, so that none of the forms can be sharply defined.

169. **Thamnophilus ruficapillus** *Vieill.*—One specimen, female, Oct. 13, 1885.

170. Dysithamnus mentalis (*Temm.*).

Myiothera mentalis Temm. Pl. Col. 179, fig. 3.
Dysithamnus[1] *mentalis* Burmeister, Syst. Uebers. Th. Bras. III, 1856, p. 82. —Sclater, Cat. Bds. Brit. Mus. XV, 1890, p. 221. Also of most recent authors.
Myiothera poliocephala Wied, Beitr. Naturg. Bras. III, ii, 1831, p. 1098. (Types examined.)
Thamnophilus olivaceus Tschudi, Faun. Per. p. 174, pl. xi, fig. 1 (♂ juv.).
Dysithamnus olivaceus Cabanis, Wiegm. Arch. 1847, i, p. 278; and of subsequent writers.
Dysithamnus semicinereus Sclater, P. Z. S. 1855, pp. 90, 147, pl. xcvii; and of later writers.
Dysithamnus affinis Pelzeln, Orn. Bras. 1869, pp. 80, 149.
Dysithamnus tambillanus Tacz. Orn. Pér. II, 1884, p. 30.

This species is represented by 68 specimens, of which 25 are adult males, 6 young males in transition plumage, and 37 females. They were taken as follows, each month of the year being represented: January, 1; February, 13; March, 5; April, 6; May, 7; June, 9; July, 6; August, 8; September, 5; October, 3; November, 4; December, 1.

The adult males vary considerably in general coloration, particularly above, but mainly in respect to the depth or intensity of the slaty tints; those in fresh plumage are generally more olive than those taken later in the season. The amount of white on the throat and breast is somewhat variable; in some specimens the throat is mottled white and gray, lightest medially; in others white prevails, in others gray; and the same is true in a general way for the breast. Generally the gray and white produce a clouded effect, without forming any clearly defined markings. The middle of the belly is more or less clearly whitish, shading latterally into gray, and posteriorly into olivaceous; flanks more or less strong olivaceous. At the lower posterior corner of the auriculars is usually a narrow line of silvery white feathers, readily distinguished, however, only in specimens which have the plumage smooth and in good condition. There is a tendency to the same mark in some of the females. The amount of white tipping the wing-coverts also varies, the greatest amount of white being sometimes on the outer row and sometimes on the middle row; sometimes there are two well-defined narrow wing-bars, and sometimes one or the other is obsolete.

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[1] Spelled *Dasythamnus.*

The females are more variable than the males, the dorsal region varying from tawny olive to dark greenish olive, while the color of the head varies proportionally in intensity. In fresh plumage the whole lower surface is often strongly washed with yellowish olive, passing into brownish olive on the flanks and to olive brown on the breast. In other specimens taken at the same season the whole middle of the abdomen is nearly pure white, and there is much white on the throat, while the color of the olive is less yellow.

Young males appear to be at first like the females, passing into the adult male dress by a single molt. Several young males, taken in May, are in transition plumage, the head being mixed slaty and brown, and the back partly olive and partly gray.

Thamnophilus olivaceus Tschudi (= *Dysithamus olivaceus* Cab.) seems to be beyond question a young male. The description and figure might well have been taken from a specimen like No. 33,880 of the Chapada series.

In view of the large amount of what seems to be individual and seasonal variation (perhaps partly due to age), I have adopted for this species the earliest name given to any member of the *mentalis* group, being unable to distinguish clearly more than a single species. Possibly with more material it might be feasible to recognize several geographical forms, but at present I fail to recognize any differences by which the few Guatemala, Costa Rica and Bogota specimens at hand can be distinguished from the Chapada series. *Dysithamnus affinis* Pelz., based on a pair of birds from Villa Barra, Matto Grosso, agrees with average specimens from Chapada, so far as can be judged by Pelzeln's description ; while *D. tambillanus* Tacz., from Tambillo, Peru, appears to agree with the Chapada specimens having a minimum amount of olivaceous. Apparently the most distinct local form represented by the material before me is the series recently collected by Mr. Chapman in the Island of Trinidad, these specimens differing from all of the others in the almost entire absence of olive from the lower back and rump, and its great reduction on the lower flanks and crissum. Slightly immature specimens would, however, not be readily separable from adults from other localities.

171. **Herpsilochmus longirostris** *Pelzeln.*—The series of 47 specimens includes 23 adult males, 3 young males, and 21 females, and represents every month in the year, having been collected as follows : January, 1 ; February, 8 ; March, 4 ; April, 6 ; May, 10 ; June, 6 ; July, 1 ; August, 2 ; September, 3 ; October, 2 ; November, 1 ; December, 3.

The adult males vary greatly in coloration, particularly in the amount of spotting, both above and below. In some there is no trace of either black or white in the dorsal area ; in some there is more or less concealed black, but no white ; in others there is very little white ; generally there is both black and white, the white being concealed, and the black frequently showing as well defined streaks on the surface. Below there is generally more or less dusky clouding on the breast, though sometimes so faint as to be barely perceptible ; at other times it is well defined, and sometimes takes the form of sharply define black streaks.

The females vary more or less in intensity of coloration, most noticable below, where the breast varies from pale cinnamon to deep rusty brown.

A young male (taken Jan. 8) is partly in first plumage ; the portions remaining of the first plumage indicate that the young bird is at first dark rusty brown above and yellowish brown below. The second plumage is essentially that of the adult, except that the black feathers of the cap are all edged more or less with bright rust color, and there is a slight buffy wash below and on the edges of the remiges, as shown in a specimen taken Feb. 18.

Pelzeln's *H. atricapillus* is probably not different from his *H. longirostris*. The alleged differences in size and in the length of the bill are without significance in the light of the variations shown in the present large Chapada series, as already detailed. I am, however, unable to account for his female, which he describes as being similar to the male, but with a longitudinal white stripe on the pileum (!), with the underparts strong yellowish brown. For this reason I take the name *H. longirostris* in preference to *H. atricapillus*, although the latter stands first on the page (Orn. Bras., pp. 80 and 150) Natterer obtained both species, it will be observed, at Porto do Rio Parana, as well as further westward in Matto Grosso, hence, if distinct, they occur together over a wide area.

172. **Formicivora rufa** (*Wied*).

Myiothera rufa WIED, Beitr. Naturg. Bras. III, ii, 1831, p. 1095. (♀—type examined.)

Formicivora rufa MÉNÉTRIÉS, Mém. Acad. St. Pétersb. sér. vi, Sci. Nat. I, 1835, p. 497, pl. ix, fig. 1.—SCLATER, P. Z. S. 1858, p. 240.—ALLEN, Bull. Am. Mus. Nat. Hist. II, 1889, p. 253.

Thamnophilus rufater D'ORB. & LAFR. Syn. Av. i, p. 12 (Mag. de Zool. 1837). (♂ and ♀.)

Formicivora rufatra D'ORB. Voy. Ois. 1833–44, p. 180.—SCLATER, P. Z. S. 1858, p. 239; *ibid.* Cat. Bds. Brit. Mus. XV, 1890, p. 250. Also of most recent writers.

Three adult males, May 22, Aug. 5, and Dec. 8; 1 young male, March 20; 1 adult female, May 24.

As I have previously stated (l. c.), Wied's name *rufa*, based on the female, has six years' priority over *rufatra* of d'Orb. & Lafr.

173. Cercomacra cærulescens (*Vieill.*).—Cachoeira, two specimens, Jan. 29.

174. Myrmiceza atrothorax (*Bodd.*).—Two adult males, May 25 and June 4; two adult females, May 25 and June 6.

175. Corythopis calcarata (*Wied*).—This species is represented by 18 specimens, taken as follows: January, 1; February, 2; March, 2; April, 2; May, 2; June, 1; August, 1; September, 1; November, 6.

A young bird in first plumage taken Nov. 6, with the quills of the wings and tail only about two-thirds grown, differs little in coloration from the adults; the olive of the upper surface is a little more tawny, and the pectoral band is a litttle duller black and faintly tinged with olive. There seems to be no sexual difference in coloration among the adults.

176. **Glaucis hirsuta** (*Gm.*).—One specimen, ♂ ad., Sept. 7, 1885.

177. **Phaëthornis pretrii** (*L. & D.*).—Eight specimens, taken as follows: January, 1; July, 2; August, 3; September, 1; October, 1. Also nest and eggs, taken Oct. 9.

178. Pygmornis chapadensis, sp. nov.

Similar to *P. longuemareus* but much paler in all parts. The bronzy green of the back is much paler; the rump and upper tail-coverts are rusty buff instead of rufous; the middle tail-feathers are more attenuated, their basal portion lighter bronze green and less dusky, and the light apical portion longer and whiter; the lower parts are strong buff rather than rufous; the chin is only slightly dusky instead of blackish; the lower tail-coverts are buff instead of white, and the outer vanes of the outer tail-feathers are strong rusty-buff, which color also occupies the apical portion of the inner vanes. Bill dusky, the lower mandible whitish for the greater part of its length. Wing, 1.20 in.; tail, 1.75; bill, 1.10.

Type, and only specimen, No. 34,078, ♂ ad., Chapada, Matto Grosso, Brazil, March 12, 1883, Coll. H. H. Smith.

This species finds its nearest ally in *P. longuemareus*, of Cayenne and Trinidad, from which I should hardly dare to separate it on the basis of a single specimen were it not that its habitat is so far removed from the known range of *P. longuemareus.* The pale rump and upper tail-coverts, the buff instead of white lower tail-coverts, and the very differently colored tail, are the important points of distinction.

179. **Eupetomena macroura** (*Gm.*).—Nine specimens, taken as follows: February, 1; May, 4; August, 1; September, 2; November, 1.

180. **Lampornis violicauda** (*Bodd.*).—One male, March 7; one female, August.

181. **Petasophora serrirostris** (*Vieill.*).—Represented by a series of 36 specimens, taken from April 24 to Sept. 24.

182. **Heliomaster furcifer** (*Shaw*).—One adult male, Aug. 8; two young males, April 5 and June 21; two adult females, May 21 and 29.

183. **Thalurania eriphile** (*Less.*).—Of the series of 25 specimens all but three are males, and most of them are adult. They were taken as follows: January, 3; February, 2; March, 1; May, 4; July, 5; September, 11; October, 1.

184. **Heliactin cornuta** (*Wied*).—One adult male, Aug. 21, and two females, one each in July and August.

185. **Calliphlox amethystina** (*Gm.*).—The 7 specimens include two adult males (taken May 20), two females (May and October), and three young males (May and October).

186. **Lophornis magnifica** (*Vieill.*).—Three males, April and August.

187. **Chrysuronia ruficollis** (*Vieill.*).—Two males and two females, June.

188. **Chrysolampis moschitus** *Linn.*—One male, August. The specimen is labeled, "Chapada, Matto Grosso, Aug., 1882." This locality seems to be rather beyond its usually recognized habitat.

189. **Agyrtria brevirostris affinis** (*Gould*).—Of the 32 specimens, 19 were taken in September, 4 in October, 3 in July, and 2 each in January, May and June, and 1 each in February and April.

190. **Polytmus thaumantias** (*Linn.*).—Three specimens, January and May (females), and June (male).

191. **Chlorostilbon pucherani** (*Bourc.*).—Five males and two females, July, August and September.

192. **Hemiprocne zonaris** (*Shaw*).—Four specimens, June, August and October.

193. **Cypseloides senex** (*Temm.*).—One specimen, female, with nest, Nov. 4, 1882.

194. Caprimulgus parvulus *Gould.*—One male, Sept. 8; two females, Oct. 5 and 6.

195. Nyctidromus albicollis derbyanus (*Gould*).—The series of 26 specimens was taken as follows: January, 0; February, 2; March, 1; April, 2; May, 1; June, 1; July, 4; August, 3; September, 1; October, 2; November, 3; December, 6. The two sexes are equally represented.

This series presents a wide range of color variation, but may be roughly separated into two sets, a gray phase and a red phase, the latter represented by 12 specimens, the former by 14. The gray phase may be separated into a dark gray series and a light gray series, with various intermediate specimens connecting the two. The same is also true of the red phase. These intermediate specimens form also a connecting series between the red and gray phases.

The females average smaller than the males, but a large female is frequently as large as a small male. In the females the wing varies from 6.15 to 6.75 in., averaging 6.38; the tail from 5.50 to 6.60, averaging 6.20. In the males the wing varies from 6.40 to 7.15, averaging 6.55; the tail from 6.40 to 7.20, averaging 6.75. The wing averages *longer* than the tail in the females, and *shorter* than the tail in the males.

Nyctidromus albicollis (Gm.) was originally based on Latham's White-throated Goatsucker from Cayenne. Specimens from Cayenne and the equatorial parts of tropical America are, as noted by Mr. G. B. Sennett (Auk, 1888, p. 46), much smaller than those from Mexico and Texas on the one hand, and from southern South America on the other, and also somewhat different in coloration; although in this latter respect there is everywhere so wide a range of individual variation that it is difficult at present to define the color characteristics peculiar to different geographical areas. Having had an opportunity to go over the large amount of material brought together by Mr. Sennett (*cf.* Auk, 1888, p. 46), I quite agree with him in the desirability of separating the species into at least three races, which may be designated as follows:

1. *Nyctidromus albicollis* (Gm.).—Equatorial America.

2. *Nyctidromus albicollis merrilli* Sennett. — Southern Texas and northern Mexico.
3. *Nyctidromus albicollis derbyanus* (Gould).—Southern Brazil and Bolivia.

196. **Hydropsalis torquata** (*Gm.*).—One male, May 5; one female, June 5.

197. **Hydropsalis furcifera** (*Vieill.*).—One female, July 6.

198. **Chordeiles virginianus** (*Gm.*).—One female, Sept. 26.

199. **Chordeiles pusillus** *Gould.*—Four specimens, April, June and August.

200. **Podager nacunda** (*Vieill.*).—Five specimens, August, September and November.

201. **Lurocalis nattereri** (*Temm.*).—One male, Sept. 26.

202. **Nyctibius jamaicensis** (*Gm.*).—One specimen, male, August 31.

203. **Ceryle torquata** (*Linn.*).—One female, Jan. 18.

204. **Ceryle amazona** (*Lath.*).—Three specimens, November.

205. **Ceryle americana** (*Gm.*). — Three specimens, two males and one female, September, October and December.

206. **Ceryle superciliosa** (*Linn.*).—One female, without date.

207. **Momotus momota subrufescens** (*Scl.*).—The series of 24 specimens, 13 males and 11 females, was taken as follows: January, 1; February, 8; March, 1; April, 1; May and June, 0; July, 2; August, 1; September, 2; October, 2; November, 5; December, 1.

There is much individual variation in coloration shown in the present series, but no very obvious sexual variation in this respect. The size of the black patch on the crown is twice as large in some specimens as in others; in some the hind neck is strongly washed with chestnut, and generally faintly so, but in several there is no trace of this tint, the whole hind neck being deep green like the back. Below many of the specimens are deep rufescent, others are paler with a strong tinge of green.

In four specimens killed while in molt, the middle tail-feathers are one-half to nearly full grown, with the webs entire, though a little narrower at the point where they are usually denuded. In other specimens the denudation has only slightly advanced, so that in the present series are specimens showing a series of stages from the new feather entirely intact, to those in which the denudation has been completed. In one specimen, in which the middle tail-feathers have scarcely reached full length, five barbs have been plucked from the inner vane of the right feather; in another of corresponding stage of tail growth, four or five barbs have been plucked from the outer vane of each feather, and others have the appearance of having been nearly severed. In another eleven barbs are missing from the outer vane of the right feather, while one is left alone about midway the gap. In another three or four barbs are missing from the outer vane of both feathers; in another the outer vane of the right feather is denuded for an inch and the opposite vane of the same feather for about three-fourths of an inch, while the other feather is denuded in the same way—the outer side more than the inner—but for a shorter distance. In another specimen both vanes of each feather are about equally denuded, the bare space being a little less than three-fourths of an inch. In another the bare space is about one inch on the right feather, with a few barbs left scattered at intervals, while on the opposite feather the bare space is less and is longer on the outer vane than on the inner vane. Another is denuded for about half an inch on both vanes of the left feather, and on the right feather for an inch on the outer and half an inch on the inner. Another is denuded for half an inch on both vanes of both feathers. These specimens, and others like them, were taken in February and March. In the November specimens the two vanes of both central rectrices are evenly denuded for a space of about an inch and a half, the bare space beginning about an inch and a half from the tip of the feather.

It would thus seem that the central tail-feathers have both webs intact when first developed; that the process of denudation begins about as soon as the feathers have reached their growth, and that the denudation proceeds very gradually and unsymmetrically, being pushed faster on the outer vane than on the inner, and that several weeks may elapse before the denudation is completed. Some of the isolated barbs left temporarily in the denuded spaces obviously show hard treatment, as if they had been rumpled and twisted in an unsuccessful effort to remove them. Finally, that in this species at least, the barbs are forcibly removed by the birds themselves in an attempt to make the feathers conform to a definite fashion. Quite similar conditions are also shown by a large series of *Momotus cæruleiceps* in the collection of Mr. George B. Sennett.

The genus *Momotus*, as treated recently by Mr. Sclater (Cat. Bds. Brit. Mus., XVII, 1892, pp. 318-330, pll. ix-xi), contains 11 species, one of which has the entire crown blue (*M. cæruleiceps*), and two have the whole top of the head and nape chestnut (*M. mexicanus* and *M. castaneiceps*), while the remaining eight have the centre of the crown black bordered with blue. Of these, one (*M. swainsoni*, confined apparently to the islands of Trinidad and Tobago) has the whole lower parts deep cinnamon rufous. The remaining seven form a very closely-related group, extending from southern Mexico south over the greater part of South America to southern Bolivia and southern Brazil. Two may be separated rather sharply from the rest on the ground of size and general coloration, namely :

Momotus lessoni, ranging from southern Mexico to Veragua and Costa Rica. This is a small form (the smallest of the black-crowned group), with the chin and throat generally clear bluish green, and the general plumage a deeper, purer green (frequently bluish green below) with less of the rufescent tinge both above and below than in the more southern forms. It apparently intergrades in Costa Rica with *M. subrufescens* ; and Mr. Sclater (l. c., p. 326) gives a list of "intermediate specimens between *M. lessoni* and *M. cæruleiceps*"!

Momotus æquatorialis, from "Ecuador and Colombia." This is a large form (the largest of the black-crowned group), of much the same general color as *M. lessoni*, but with less of the bluish shade on the throat, and lacking the terminal black bar to the tail, more or less distinctly developed in *M. lessoni* and all the other members of the black-crowned group. It is, however, a very much larger bird than *M. lessoni*, with the tail three to four inches longer.

Next to *M. æquatorialis* in size and coloration is *M. momota*, of northeastern South America and the Lower Amazonian region. In general coloration it closely resembles *M. æquatorialis*, but differs from it in having the tail narrowly tipped with black, and in the presence of a distinct nuchal band of chestnut. It also appears to average somewhat smaller.

The remaining four species—namely, *M. subrufescens*, *M. nattereri*, *M. microstephanus* and *M. bartletti*—belong strictly to the *M. momota* group, as well also as Mr. Sclater's provisionally designated *M. parensis* (l. c., p. 320, in text), and *M. argenticinctus* (l. c., p. 326, in text). They may include several recognizable geographical forms, but even this seems uncertain (except on general grounds), in view of the wide range of variation shown in the Chapada series and the character of the alleged differences by which these several species are supposed to be distinguishable. On the basis of the wide extent and the diverse physical conditions of the different parts of the general habitat of the group, it is probable that different regions are inhabited by forms separable as subspecies, on the basis of average differences in size and coloration. On the other hand, it is extremely improbable that these various forms will be found to be more than rather unstable intergrading geographical races. For instance, I have before me specimens from Panama, Costa Rica, Santa Marta, Bogota and Bolivia, which I am unable to distinguish in any way from specimens in the Chapada series. In fact, Mr. Sclater gives the habitat of *M. subrufescens* as "From Panama to Colombia and Venezuela, south to Matto Grosso," and at the same time refers part of the Chapada specimens (he appears to have had nine from the Chapada series) to his *M. nattereri*; to which latter he also refers specimens from as distant points on either side of Chapada as Pernambuco and Bolivia, and from as far north as Chamicuros, Upper Amazon.

As already said, the size of the black coronal spot, the presence or absence of an incipient nuchal crescent of rufous, or the entire absence of rufous on the sides and back of the neck, the exact shade of the cobalt band surrounding the coronal spot, and particularly the breadth and tint of its nuchal portion, the presence or absence of an ochraceous shade over the mantle and hind neck, and the color of the lower parts in respect to the prevalence of a greenish or an ochraceous suffusion, are all features that vary through wide limits in specimens taken at the same locality and practically at the same date. Hence I believe it will far better reflect the facts of the case if for the present we consider *M. nattereri*, *M. microstephanus* and *M. bartletti* as probably synonyms of *M. subrufescens*, and the latter as a subspecies only of *M. momota*. In all probability *M. lessoni* and *M. æquatorialis* are also only subspecies of the *M. momota* group.

208. **Trogon variegatus** *Spix*.—Ten specimens, eight males and two females—January, February, May, June, July, October, November and December.

209. **Colaptes campestris** (*Vieill.*).—The 26 specimens represent every month in the year except May and June, and include three birds in first plumage taken in November.

Young in first plumage differ very little in coloration from adults, except in respect to the yellow, which is much paler and less extended in area, and in having the feathers of the malar region deep black, instead of tipped with white or red, as in the adults.

210. **Chloronerpes chrysochlorus** (*Vieill.*). — One male, Corumba, Feb. 26; one female, Piedra Blanca, April 20.

211. **Chrysoptilus icteromelas** (*Vieill.*).—One male, June 11; one female, December.

Doubtless a large series of specimens from numerous localities would show that several of the currently recognized species of this group, allied to the present form, would indicate their real status to be simply that of geographical races or subspecies.

212. **Leuconerpes candidus** (*Otto*). — The 8 specimens representing this species were taken as follows: in April, 2; May, 1; July, 2; September, 1; November, 2.

The females not only lack the lemon-yellow nuchal crescent, but have also rather less yellow on the abdomen. A young male in first plumage, with the quills not fully grown, differs from the adult males in having the black of the dorsal plumage a little duller and the lemon-yellow of the abdomen less extended and of a lighter or clearer yellow.

213. **Melanerpes cruentatus** (*Bodd.*).—Of the 8 specimens of this species 5 were taken in February, 2 in September, and 1 in October.

Nearly all have the sides of the abdomen more or less strongly tinged with yellow.

214. **Dryobates cancellatus** (*Wagl.*).—Two adult females, May 22 and Sept. 23.

215. **Dendrobates olivinus** (*Malh.*).—This species is represented by 32 specimens, 23 males and 9 females, taken as follows: January, 4; February, 8; March, 4; April, 3; May, 0; June, 2; July, 1; August, 4; September, 4; October, 0; November, 1; December, 1.

The coloration varies much even among adults of the same sex. A few specimens, perhaps young birds, of each sex have faint whitish shaft stripes on the interscapulars, and generally the dorsal plumage is crossed by faint yellowish cross-bars, but occasionally both shaft-streaks and cross-bars are nearly or wholly obsolete. A few specimens in high plumage have the scapulars and interscapulars faintly tinged with red. Below the general color varies from dull olivaceous brown, with very little or no shading of green, to strong greenish olive brown, with the narrow transverse bars varying from whitish to olivaceous. Two young males (probably birds of the year) have the whole top of the head bright red.

216. **Celeus lugubris** (*Malh.*).—Piedra Blanca, Bolivia, 2 adult males, April 20 and 21, and 1 adult female, April 20; Chapada, 1 adult female, April 22; 1 young female (?), March 14.

The first four of the five specimens above enumerated—two males and two females—are apparently adult, and agree with Malherbe's description of his *C. lugubris*. The posterior upper tail-coverts in all are deep chestnut brown, plain in three of them, in the other (a young female) broadly barred with black. The tibial plumes are dusky in all, slightly varied with yellow.

The fifth specimen (No. 34,294) has the appearance of an immature bird, the plumage of the lower parts being heavily edged with deep chestnut brown ; the dorsal plumage in much lighter, with the yellow cross-bands much broader ; the yellow of the head is of a duller, more creamy tint ; the tibial plumes are *wholly yellow*, as are also all of the upper tail-coverts, while the lower tail-coverts are ferruginous barred with black. The outer vanes of the inner primaries, and the apical half of both vanes of the secondaries, are uniform ferruginous, less dark than in the other specimens, and entirely without the broad blackish cross-bars seen in the others. My impression is that this is a young bird, and that the others are adult, in which case Mr. Hargitt (Cat. Bds. Brit. Mus., XVIII, p. 425) has reversed the characters of the adult and young in his account of the species ; his account being also at variance with Malherbe's, as regards the characters of the adult and young.

217. Cerchneipicus occidentalis *Hargitt.* — One female, May 19.

218. Campephilus trachelopyrus (*Malherbe*).—One ♂ ad., May 19 ; one ♀ ad., March 30.

219. Campephilus melanoleucos (*Gm.*).—Three males and one female, November, 1882.

220. Ceophlœus lineatus (*Linn.*). — The 8 specimens, 4 ♂ and 4 ♀, were taken as follows : February, 2 ; March and April, 1 each ; July, 2 ; August, 2 ; September, 1.

The specimens present wide variation in respect to the color of the lower parts, due mainly to accidental staining. In freshly-molted birds the light bars of the lower plumage are probably nearly pure white, but soon the light color becomes soiled or tinged more or less with a buffy or creamy tint, varying in amount in different specimens. A female (No. 34,184), taken Sept. 4, has all of the white areas, including the stripes on the head, neck and scapulars, deeply stained with rust-color, most deeply on the ventral surface, sides of the neck, throat and edge of the wings, and palest on the posterior part of the scapular stripe. A July male is similarly stained, but not quite so uniformly nor to so great a degree; several other specimens show the same staining on the bend of the wing and irregularly over the ventral surface.

221. **Picumnus guttifer** *Sundev.*—This species is represented by a fine series of 37 specimens, consisting of 19 males, 13 females, and 5 young, taken as follows: January, 7; February, 3; March, 2; April, 2; May, 3; June, 4; July, 2; August, 5; September, 5; October, 1; November, 1; December, 2.

The adults appear to differ very little in coloration, except in the markings of the head, the males having the feathers of the crown broadly tipped with bright red, and the females with circular spots of clear white. The young during the first year appear to have the crown plain brown, without spots. Three young males are just acquiring the red spots on the crown; in one there are merely a few spots of red; in another half the spots are red and the rest orange-red; in the third the spots are mainly yellow, mixed with a few red and orange-red spots.

In young birds the markings, particularly below, are less sharp than in the adults, and the general plumage is slightly more suffused with buffy.

222. **Rhamphastos toco** *Müll.*—Five specimens—Feb. 19 and Oct. 7–31.

223. **Pteroglossus castanotis** *Gould.*—Nearly every month in the year is represented by the series of 25 specimens.

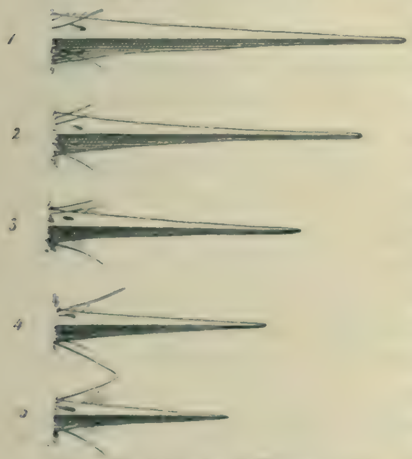
The principal variation in coloration is in respect to the amount of chestnut on the throat, sides of the neck, nape and crown, which varies exceedingly in different specimens.

In some the nuchal band is very narrow, and there is merely a trace of a chestnut coronal spot; in others the whole nape is chestnut, this color extending forward to become confluent with a large coronal spot of the same color, which occupies nearly the whole top of the head. In the same way it extends from the sides of the neck so as to cover not only the chin and upper throat but the lower throat and extreme upper part of the breast, leaving only a rather narrow pectoral area of black. This variation is doubtless largely due to age, the younger birds having much the most chestnut.

The bill also varies much in color, in the prominence of the serrations, and especially in size. Birds that are obviously rather young have the serration the least developed, and the colors paler and less strongly contrasted. The bill, measured in a straight line from the posterior angle of the lower mandible to the tip of the upper, varies from 3.60 to 4.75 in. While there is much purely individual variation, the smallest bills belong to what are unmistakably young birds.

224. Galbula rufoviridis *Cab.*—The 32 specimens representing this species were taken as follows: January, 3 ♂; February, 1 ♂; March, 1 ♂, 1 ♀; April, 3 ♂, 3 ♀; May 4 ♂, 1 ♀; June, 1 ♀; July, 3 ♀; August, 1 ♂, 1 ♀; September, 3 ♂; October, 0; November, 4 ♂; December, 0. The 11 females were all taken between March and August, while no males were taken in June and July, which seems to be a rather singular seasonal distribution of the sexes.

In fully adult individuals there is very little sexual variation in color, aside from the throat, which is white in the male and pale rufous in the female. There is a large amount of variation in the color of the upper parts, which in some specimens is vivid metallic golden green, when held in 'position C,'[1] and in others, when held in the same position, purplish coppery bronze. Others (generally specimens obviously in molt) present a mixed plumage, some of the feathers being green and the others bronze, and in some instances the new feathers are deep purplish bronze. In different specimens, also, the bronzy tint varies from golden bronze to purplish bronze.



EXPLANATION OF FIGURES.

Variation of bill in *Galbula rufoviridis.*

1. No. 34,380, ♂ ad., Jan. 6.
2. No. 34,408, ♂ ad., Nov. 16.
3. No. 34,381, ♂ ad., Jan. 17.
4. No. 58,636, ♂ (juv.?) (adult as regards plumage), Jan. 16.
5. No. 34,409, ♂ (juv.?) Nov. 16.

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[1] *Cf.* Garrod, P. Z. S., 1882, pp. 419, 420.

The bill varies exceedingly in respect to both length and slenderness, ranging from 1.25 to 2.25 in. in length, as shown in the accompanying figures, drawn natural size. The five specimens here figured are all males, and apparently adult, so far as can be determined by the plumage. The two shortest billed specimens have the extreme tip of the bill whitish, recalling the whitish knob often seen on the tip of the bill in newly-hatched birds. Presumably some of the variation here shown is due to age, but it is doubtless mainly purely individual.

225. **Brachygalba melanosterna** (*Cab.*).—Of the 26 specimens representing this species all were taken between the first of January and the first of August, as follows: January, 8; February, 5; March, 5; April, 0; May, 4; June, 0; July, 4. The February and March specimens were taken at Abrilongo (12 miles from Chapada), and the rest at Chapada.

The general coloration is quite constant; the variation shown seems to be wholly independent of sex, and not very clearly connected with season, specimens presenting the widest and perfectly parallel variations having been taken in both January and July. In none of the specimens is the bill wholly white; in those with the whitest bills the basal half of the upper mandible is dusky; in the other extreme the whole bill is black except the basal third or fourth of the lower mandible, which is whitish. In many of the specimens the whole upper mandible and the apical half of the lower is black. The bill varies comparatively little in size.

The chin is always white or whitish, passing into buff on the upper throat, and then into rufescent dusky on the lower throat. The abdomen is occasionally nearly pure white, but is usually more or less buffy, in some specimens strongly so. The "smoky brown" cap has the feathers usually more or less edged with lighter, this lighter edging varying from buffy white to deep ferruginous. In specimens having the cap rufous there is generally also more or less rufous on the throat, and the white of the abdominal area is tinged rusty.

226. **Bucco maculatus striatipectus** (*Scl.*).—Three specimens—Corumba, 2 ♂, March 12; Chapada, 1 ♀, July 20.

227. Bucco chacuru *Vieill.*—The series of 20 specimens was collected as follows: February, 1; March, 3; April, 1; May, 2; June, 1; July, 1; August, 2; September, 6; November, 1; December, 2. It is thus probably present at Chapada in small numbers throughout the year.

In fresh plumage the breast, and sometimes the middle of the belly, is quite strongly tinged buff, which mainly disappears in the breeding season, probably from fading; the dorsal surface is also light reddish brown, varied with narrow blackish cross-bars, but later the brown becomes duller and darker, and the blackish basal portions of the feathers become more prominent, from the wearing away of the apical brownish portions. There thus results a large amount of seasonal variation, due to fading and abrasion. The sexes appear to be indistinguishable in coloration.

228. Monasa nigrifrons (*Spix*).—A series of 11 specimens, of which 8 were taken in February, 2 in June, and 1 in January.

Two of the February specimens have the general plumage dull gray, tinged more or less with rusty, the chin, forehead and cheeks being mainly of this color.

229. Chelidoptera tenebrosa brasiliensis (*Scl.*).—This species is represented by 14 specimens, of which 7 were taken in January, 1 in April, 1 in May, 1 in June, 2 in September, 1 in October, and 1 in November. They present a wide range of variation in coloration, which is quite independent of season or locality. The lower breast is generally more or less mixed cinereous and black, varying on the one hand to nearly pure cinereous and on the other to black. Similarly the abdomen varies from ochraceous to chestnut. An October specimen is as dark as any of the January series; and among the darkest and the lightest both sexes are represented. Some of the dark specimens are as dark as Cayenne examples, and the lighter ones are like Bahia specimens.

Probably northern examples (from Cayenne and Amazonia) will average smaller and darker than southern ones, but the difference is inconstant and only a matter of general average.

230. Coccyzus melanocoryphus *Vieill.*—One specimen, ♂, April.

231. Coccyzus americanus (*Linn.*).—One specimen, ♂, Oct. 28, 1883.

232. Piaya cayana cabanisi, subsp. nov.

Pyrrhococcyx macrourus CAB. J. f. O. 1862, p. 168 (Montevideo and southern Brazil. Not *Piaya macroura* GAMBEL, 1849, based on a bird from "Surinam"=*Cuculus cayanus* Linn.).

Pyrrhococcyx macrurus CAB. & HEIN. Mus. Hein. IV, 1862, p. 86.

This is the large southern form of *P. cayana* described by Cabanis as above, but under a preoccupied name.

The 24 specimens representing this subspecies were taken as follows: January, 1; February, 2; March, 2; April, 2; May, 1; June, 3; July, 1; August, 5; September, 2; October, 1; November, 2; and 2 without date. Sexed as males, 11; sexed as females, 10; not marked for sex, 3.

This series is quite uniform in coloration, the variation observable being chiefly seasonal. Birds in fresh plumage (March to August) are of rather lighter, brighter rufous above than those taken toward the close of the breeding season (September to November), which have become, through fading, somewhat duller and paler. In the same way the lower surface of the tail, in fresh plumage, is faintly suffused with dull rufous, except for a broad subapical bar of dull blackish, not sharply defined proximally, where the blackish band shades off into the general color of the lower surface of the rectrices. Later in the season this brownish suffusion becomes less distinct, and in occasional specimens almost disappears, leaving the lower surface of the rectrices, posterior to the apical white spot, blackish with a faint tinge of dull rusty brown.

The bills vary much in size, as regards both length and stoutness, and also in color, particularly in the amount of yellow on the convex portion of the culmen.

The males average slightly larger than the females, but the sexes do not appear to differ at all in coloration. In the males the wing averages 6.00 in., the tail 11.60; in the females the wing averages 5.80 and the tail 11.45.

Authors differ greatly in their treatment of the Cuckoos of the *Piaya cayana* group, some separating them into half-a-dozen species, others regarding them as forming a single species. A glance at a large series of specimens from a wide range of localities is sufficient to show that neither of these extreme views is tenable, but that several strongly-marked geographical forms can at once be separated. Hence, in order to determine the proper designation of the bird represented by the Chapada series, it has been necessary to review the group, so far as the limited material at command renders possible.

Cuculus cayanus Linn. was based on Brisson's *Cuculus cayanensis*, from Cayenne, which is thus the typical locality for *Piaya cayana* (Linn.). On comparison of specimens from different portions of the general habitat of the so-called *P. cayana*—which extends from southern Mexico throughout tropical America—they are found to differ very markedly in coloration and in size. These differences have attracted the attention of various authors, and numerous supposed species have been named, till the list of synonyms, as compiled by Mr. G. E. Shelley, in his recent Catalogue of the Cuculidæ (Cat. Bds. Brit. Mus., XIX, 1891, pp. 373, 374) numbers not less than fifteen distinct names, aside from various additional orthographic variations. Many of these are of course pure synonyms, or more or less indeterminable, while others are available for the designation of a number of well-marked subspecies or geographic forms.

The most distinct, and geographically the most isolated, member of the group is *Piaya mexicana* Swain., from western Mexico, distinguished by its large size (wing 5.93, tail 11.43), the light sandy rufous tint of the upper parts, and the rufous under surface of the tail, with its rather sharply defined narrow blackish subapical bar. This by many authors is ranked as a well-defined species.

The form differing most from this is the one most closely related to it geographically, and which cuts off *P. mexicana* at the southward from the allied forms of South America, namely, the commonly so-called *P. mehleri* Bon., based on specimens from Santa Fé de Bogota. The Bogota birds, however, do not represent the extreme phase of this form, being much smaller and paler in coloration than specimens from Panama and thence northward to southeastern Mexico. In fact the two phases are so distinct that they may well be recognized as subspecies under the names respectively of *mehleri* Bon. for the Bogota and Napo form, and *ther*-

mophila Scl.[1] for the Central American form. The same general style of bird ranges southward through eastern Peru to central Bolivia, but Yungas specimens are again larger and darker than true *mehleri*, being very closely representative in size and coloration of *thermophila* Scl.

The true *Piaya cayana* should apparently be restricted to Cayenne, Trinidad, and the immediately adjoining portions of South America. It is a small form, nearly as small as *mehleri*, but very different in coloration, being lighter rufous above and with the crissum and lower parts generally, including the lower surface of the tail, much less dusky.

In northern Brazil, from at least as far south as Bahia northward, is a form slightly larger than true *cayana*, but much paler in coloration, the paler tints extending to all parts of the plumage. This is the form described by Cabanis and Heine (Mus. Hein., IV, 1862, p. 86) as *Pyrrhococcyx pallescens*.

In southern Brazil, Uruguay, and the Argentine Republic, a larger form prevails, recognized by Cabanis (J. f. O., 1862, p. 168) under Gambel's name *macrourus* (=*cayanus* Linn.). This differs little in coloration from *pallescens*, but is on the whole less pale, with the lower surface of the tail more rufescent; it is, however, of much larger size. This form, in fact, is nearly of the size of *P. c. mexicana*, and more nearly approaches it in coloration than any of the several intervening forms.

The equatorial representatives of the *P. cayana* group are thus the smallest, with a decided increase in size both northward and southward. Measurements of a considerable number of specimens (5 or 6 to 12 or more of each form) indicate the following average dimensions for the wing and tail:

Piaya cayana mexicana...........	wing,	5.93;	tail,	11.55
" " *thermophila*..........	"	5.75;	"	10.25
" " *mehleri*..............	"	5.60;	"	9.45
" " *cayana*..............	"	5.50;	"	9.50
" " *pallescens*............	"	5.76;	"	10.50
" " *cabanisi*.............	"	5.95;	"	11.55

In respect to other names that have been applied to representatives of the *P. cayana* group, probably *Cuculus ridibundus* Gm. (Syst. Nat., I, 1788, p. 414, ex Brisson), given to a Mexican

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[1] "*Hab.* In terra calida reipublicæ Mexicanæ et in Guatemalæ."—P. Z. S., 1859, p. 368.

Cuckoo, can never be identified, resting as it does on the indefinite accounts of Nuremberg and Hernandez. *Coccyzus macrocercus* Vieill. (Nouv. Dict., VIII, 1817, p. 275) is practically a synonym of *Cuculus cayanus* Linn., as is also *Pyrrhococcyx guianensis* Cab. & Hein. (Mus. Hein., IV, 1862, p. 85). *Piaya viridirostris* Würt. (Naum., II, ii, 1852, p. 55) and Bon. (Consp. Vol. Zygod., 1854, p. 6) is a *nomen nudum*, applied to some Mexican species. Gambel, in 1849 (Journ. Acad. Nat. Sci. Phila., I, p. 215), identified *P. mexicanus* Swain. with *P. cayana* (Linn.), and redescribed the latter as *P. macroura* sp. nov. *Piaya nigricrissa* Sclater (P. Z. S., 1860, p. 285), and *Pyrrhococcyx mesurus* Cab. & Hein. (Mus. Hein., IV, 1862, p. 83), are both apparently pure synonyms of *P. mehleri* Bon. *Pyrrhococcyx columbianus* Cab. & Hein. (Mus. Hein., IV, 1862, p. 82) may represent a southern form of *P. mexicana* Swain.

It is not quite clear what should be done with *Piaya circe* Bon. (Consp. Av., 1850, p. 110) "ex Columbia," for which Schlegel (Mus. Pays-Bas, I, 1862, Cuculi, pp. 57, 58) gives the type locality as Caracas, Venezuela. It is a large, strongly-colored bird, with a black crissum and the lower surface of the tail black, as in *thermophila* Sclater. Should they prove to be the same, *circe* will of course take precedence over *thermophila*, it having about nine years' priority.

The following may doubtless be looked upon as fairly distinguishable forms:

1. *Piaya cayana* (typica).—Cayenne, Trinidad, and adjoining portions of eastern South America.
2. *Piaya cayana pallescens.*—Northern Brazil.
3. *Piaya cayana cabanisi.*—Southern Brazil, Uraguay, and Argentina.
4. *Piaya cayana mexicana.*—Southwestern Mexico. (The only specimens I have seen are from the State of Colima.)
5. *Piaya cayana thermophila.*—Southeastern Mexico and southward to Panama. (Perhaps=*P. circe* Bon.)
6. *Piaya cayana mehleri.*—Colombia, Ecuador, eastern Peru, south into Bolivia. (The south Bolivian form may require separation as an additional large southern race of the *mehleri* phase of *cayana.*)

233. **Diplopterus nævius** (*Linn.*).—Of the 5 specimens representing this species, three were taken in July and one each in February and April. The February specimen is a young bird with the fore neck and breast strongly suffused with rusty buff and narrowly barred with brownish black, and the feathers of the crown broadly tipped with grayish buff.

234. **Dromococcyx phasianellus** (*Spix*).—Two specimens, —♂ ad., June 19, and a young bird in first plumage, taken Jan. 6.

The young bird in first plumage resembles the adult in general coloration above, except that the wing-coverts have broad shaft-streaks of buff, and lack the light edging seen in the adult. Below the fore neck and breast are dingy brownish olive gray, with a slight wash of buff; middle of throat paler; rest of lower surface soiled yellowish white, tinged on the flanks with gray.

235. **Crotophaga major** *Gm.*—Two specimens, ♂ and ♀, Oct. 26, 1882.

236. **Crotophaga ani** *Linn.*—The 19 specimens were taken as follows: March, 6; April, 4; June, 4; July, 1; August, 2; September, 1; November, 1.

237. **Guira guira** (*Gm.*).—Three specimens—January, September and October.

238. **Ara ararauna** (*Linn.*).—Two specimens, male and female, May and June.

239. **Ara chloroptera** *Gray.*—Two specimens, females, April 25 and Oct. 19.

240. **Ara auricollis** (*Cass.*).—One specimen, April 22.

241. **Ara nobilis** (*Linn.*).—The series of 14 specimens was taken as follows: January, 1; March, 1; June, 1; July, 5; August, 5; September, 1. Three are young specimens, lacking the red on the carpal edge of the wing.

242. **Conurus leucopthalmus** (*Müll.*).—Nine specimens, taken as follows: February, 1; March, 1; July, 4; August, 2; October, 1.

243. **Conurus aureus** (*Gm.*).—Thirteen specimens, taken as follows: January, 2; March, 1; April, 3; May, 3; July, 1; August, 1; October, 2.

244. **Pyrrhura molinæ** (*M. & S.*).—Two males, Piedra Blanca, Bolivia, April 23, 1886.

245. **Brotogerys chiriri** (*Vieill.*).—Eleven specimens—February, 4; March, 1; April, 1; May, 5.

246. **Amazona æstiva** (*Linn.*).—Two specimens, Chapada, ♂ ad., Aug. 1; Piedra Blanca, Bolivia, ♂ ad., April 23.

247. **Pionus menstruus** (*Linn.*).—Eight specimens—January, 1; February, 1; April, 5; December, 1.

248. **Megascops brasilianus** (*Gm.*).—Four specimens—February, 2 (♂ and ♀); July, 1 (♀); August, 1 (♂). The July specimen is very different from the others, being in semi-rufous plumage, about half-way between the ordinary gray phase and the typical red phase.

249. **Glaucidium phalænoides** (*Daud.*).—This species is represented by 5 specimens, taken as follows: January, 1; March, 2; July, 1; October, 1. Three are in the gray phase and two in the red phase, but no two of them are very nearly alike. One is a dark brown (ferruginous) bird, with the bars of the wing and tail feathers and the shaft stripes on the crown obsolete; another is also ferruginous, but much lighter, with the bars on the quills of both wings and tail much more distinct, and the light shaft-stripes on the crown very distinct and abruptly expanded apically; one of the 'gray' birds is clear umber, with nearly pure white tail-bars, and a few pale rusty shaft-stripes on the front part of the head; another is ferruginous umber, with the very distinct tail-bars edged with rusty, and the whole crown well streaked with very narrow, strictly linear buffy white shaft-stripes; the other is ashy umber above, with a slight suffusion of pale rufous, the tail-bars distinct and pale yellowish white, and the crown very faintly streaked with narrow ashy shaft-lines.

I adopt the name *phalænoides* Daudin as the designation of the species simply from its being the oldest name applicable to the group, without regard to whether the southern form may or may not be separable as a geographical race, under the name *ferox* Vieill., of which *ferrugineus* Wied is merely the red phase.

250. **Asio mexicanus** (*Gm.*).—One specimen, ♀ ad., Aug. 3.

251. **Syrnium huhulum** (*Daud.*).—One specimen, ♀ ad., January.

252. **Syrnium perspicillatum** (*Lath.*).—Two specimens, ♂ ad., Nov. 6; ♂ juv., Nov. 7.

The young specimen is still in the fluffy dress of the nestling bird, with the quills about two-thirds grown. The remiges and rectrices are nearly as in the adult, except that the latter are much more broadly tipped with white. The clothing plumage, both above and below, is everywhere loose and downy, and nearly uniform creamy white (rather lighter on the throat), excepting on the chin, lores, and sides of the face (including the auriculars and a narrow ring around the eyes), where it is intense black, giving the bird a very odd expression. The primary coverts are dark brown, like the quills, but the secondary coverts and tertials are buff, the latter more or less barred and mottled with brown, and interspersed with a few brown feathers of the new plumage.

253. **Asturina nitida** (*Lath.*).— Two specimens— ♀ ad., July 21; ♀ juv., Jan. 24.

254. **Rupornis magnirostris nattereri** (*Scl. & Salv.*).—This is apparently a common species at Chapada throughout the year. It is represented by 26 specimens, collected as follows: January, 1; February, 4; March, 1; April, 2; May, 0; June, 4; July, 1; August, 5; September, 1; October, 2; November, 1; December, 4. About 14 are fully adult, 5 are young, and the others in various stages of immaturity. They are all distinctly referable to *nattereri* as distinguished from true *magnirostris*.

255. **Buteo brachyurus** *Vieill.*—One specimen, Nov. 2.

256. **Buteo albicaudatus** *Vieill.*—Of the series of 18 specimens 13 were taken in August, 4 in September, and a single specimen Nov. 3.

Judging by descriptions, none of the birds in this series can be fully adult. According to Mr. Sharpe (Cat. Bds. Brit. Mus., I, 1874, p. 102), the upper parts in the adult should be "slaty gray, darker on the head," etc., and "the sides of face and throat deep slaty gray, rest of under surface white," etc. Mr. Ridgway says: "Above dark plumbeous; rump and lower parts pure white; throat plumbeous-black or bluish-plumbeous" (Proc. U. S. Nat. Mus., I, 1878, p. 155). To all appearances 11 of the 18 specimens of the present series are adult, and vary in general coloration within rather narrow limits. An average specimen may be described as follows:

Entire throat, whole head, neck and interscapulars blackish with a faint tinge of ashy—in other words, plumbeous black—with more or less concealed white on the crown; scapulars dull blackish brown, more or less edged and tinged with rufous, passing into clear deep rufous on the shoulder coverts; back brown strongly mixed and varied with rufous; rump barred about equally with rufous, plumbeous and white; upper tail-coverts white, the upper central ones narrowly and irregularly barred with plumbeous; basal two-thirds or three-fourths of the tail white or grayish white, narrowly barred with plumbeous or rusty plumbeous, particularly on the central feathers, much less so on the outer feathers, and with a very broad subterminal band of black, tipped with gray, passing into white at the extreme tip. Below, from the throat posteriorly, white or ashy white, crossed by numerous fine wavy bars of pale grayish brown, finest posteriorly and broadest across the chest, where they are more strongly tinged with rufous, with sometimes considerable rufous on the sides of the lower pectoral region. Axillars white, with heavy double bars of pale rufous and plumbeous.

The variation from this, in what seem to be practically adult birds, consists in the absence of the ashy tinge above, a slight and more or less irregular edging and spotting of rufous on the interscapulars, and heavier bars on the chest, which may vary from pale rusty plumbeous to nearly clear rufous. Or there may be less rufous over the dorsal region generally, and the lower parts, below the throat, especially centrally, may be nearly pure white without trace of cross-bars. There is little variation in the markings of the rump, upper tail-coverts and tail.

In what seems to be the next stage to this, the rufous shoulder-patch is much more restricted, the lower back is more rufous, and the rump and upper tail-coverts are heavily barred with blackish, more or less varied with rufous; the middle of the breast is mainly white, with the whole pectoral region and flanks heavily barred with mixed rufous and blackish, and the thighs conspicuously so. The basal portion of the tail, which in the adults is white, is dull gray, crossed by numerous bars of dusky.

In a still earlier stage there is no rufous on the wing-coverts, the whole dorsal surface being nearly uniform blackish brown, with in some specimens touches of pale rufous on the scapulars ; and there is generally a large amount of partly concealed white on the crown, hind head and nape. The back, rump and upper tail-coverts are spotted black and white. Below the plumage is mixed black and white, sometimes the black prevailing and sometimes the white, with no tendency to transverse markings, even on the thighs. Tail almost wholly grayish brown, crossed by a great number of indistinct lighter bars.

One specimen is brownish black throughout, both above and below, except for patches of concealed white on the head, neck and breast, and for rufous tipping and barring to the feathers of the belly, thighs and lower tail-coverts, and concealed bars of rufous on the scapulars and some of the wing-coverts.

Another specimen is entirely deep black throughout, with the rump and upper tail-coverts spotted black and white, and with much concealed white at the base of the scapulars and nape feathers. The tail is that of a normal adult except that it is much more heavily barred, and there is more or less ashy tinging the plumage of the head and back. It is hence apparently a melanistic adult, although there is no rufous on the shoulders, nor in fact anywhere in the plumage.

This is doubtless the true *Buteo albicaudatus* Vieill., in which case the Rio Grande bird, so called, is quite different, as shown by Mr. Sennett's admirable series of nearly thirty specimens from the Lower Rio Grande Valley in Texas, representing the species from the downy nestling to the fully adult birds. This northern form I propose to call

Buteo albicaudatus sennetti, subsp. nov.

In the adults of the Rio Grande form the whole lower surface is pure intense white, from the bill to the tail, excepting for a few wavy very narrow bars of grayish brown over the middle region of the body, but confined mainly to the flanks, sometimes, however, extending as faint bars to the thighs. The whole upper surface, including the outer surface of the folded wings, is ashy gray, except of course the rufous shoulder patch, and a rufous tinge on the outer scapulars. Only in more or less immature birds is the throat plumbeous. Although young birds of the Rio Grande form are brownish black spotted more or less on the rump, breast and thighs with white, at no stage is there a close agreement with corresponding phases of the Chapada series. There seems to be no great variation in size or structural features between the two forms, which doubtless completely intergrade in coloration over the area separating these two extreme borders of the habitat of the species. Yet the color variations clearly entitle the two forms to subspecific separation.

I have named this subspecies in honor of Mr. George B. Sennett, in recognition of his important contributions to our knowledge of Texan ornithology.

257. **Heterospizias meridionalis** (*Lath.*).—Represented by a series of 22 specimens, taken as follows: June, 1; July, 7; August, 9; September, 2; October, November and December, 1 each. About 12 may be considered as fully adult, but only two or three have the dorsal plumage to any great extent ashy. The rest are in various stages of immaturity, from very young birds (though all are full grown) to those nearly adult. Temminck's description (Pl. Col., text to pl. xxv) gives a very good description of the plumage of both the adult and young birds—much better than some later accounts.

Birds of the first and second years are dull brown above with more or less partly concealed yellowish white on the head and hind neck, sometimes more or less strongly tinged with ferruginous; the lesser upper wing-coverts are irregularly barred and freckled with deep rufous, as are also the greater primary and secondary coverts and the basal portion of the secondaries. The tail feathers are dull brown like the back, the basal two-thirds irregularly barred with ashy white and more or less varied with rufous. The throat is whitish or buffy white, with shaft-lines of dusky ; the lower throat and breast are soiled white, varying in different specimens to rusty white, heavily blotched with dusky ; the thighs are blackish, tinged and variegated with irregular very narrow bars of dusky ferruginous, varying in some specimens to dark ferruginous barred narrowly with black.

In what appears to be the next stage the whole upper parts, including the head, are dusky brown, the feathers of the whole head, but particularly of the nape and sides of the neck, strongly ferruginous, barred finely and centrally streaked with blackish ; the scapulars are also marginally barred with rufous, and the lesser wing-coverts are rufous barred with blackish. The chin and throat have become more or less dusky brown, the feathers narrowly barred with pale dull rufous ; some of the breast feathers are almost wholly brown, those of the middle of the breast centred with broad spots and blotches of yellowish or buffy white ; from the breast posteriorly the plumage is barred about equally with blackish brown and dull ferruginous.

In the fully adult stage—perhaps only in high plumage—the feathers of the head, back of the neck, and the scapulars are centred more or less broadly with ashy slate, and the scapulars have a strong ashy tinge in favorable lights. The lower surface generally is barred with blackish brown and dull rufous, the rufous bars the broader; the thighs are much deeper, brighter rufous, with very narrow bars of blackish, in some specimens wholly obsolete. The white tail-bars have become reduced to one broad bar placed about midway the tail, and a narrow tipping of white.

Apparently several years are required in attaining adult plumage, resulting in a great variety of intermediate stages. There is also apparently considerable variation in the intensity of the rufous in birds of nearly the same age.

258. **Parabuteo unicinctus** (*Temm.*).—One specimen, ♂ ad., June 26.

259. **Leucopternus albicollis** (*Lath.*).—Two specimens, ♂ ad. and ♀ ad., Oct. 7.

260. **Harpyhaliaëtus coronatus** (*Vieill.*).—One specimen, ♂ ad., Oct. 20.

261. **Spizaëtus mauduyti** (*Daud.*).—One specimen, ♀ ad., Oct. 11.

262. **Spiziastur melanoleucus** (*Vieill.*).—One specimen, ♀ ad., Oct. 1.

263. **Accipiter pileatus** (*Temm.*).—Three specimens, ♂ ad., June 30; ♂ juv. and ♀ juv., May 15.

264. **Accipiter** (sp. incog.).—One specimen, ♂ juv., Jan. 19. Probably referable to *A. guttatus* (Vieill.).

265. **Micrastur ruficollis** (*Vieill.*).—Three specimens, ♂ ad., May 3; ♂ juv., May 16; ♀ ad., Aug. 17.

266. **Geranospiza cærulescens** (*Vieill.*).—One specimen, ♀ ad., Jan. 24.

267. **Falco fusco-cærulescens** *Vieill.*—The 5 specimens representing this species were taken: 2 in July, 3 in August, and 1 in December.

268. **Falco rufigularis** (*Daud.*).—Two specimens—Chapada, ♂ ad., Nov. 12; ♀ ? ad., Piedra Blanca, Bolivia, April 20.

The November specimen is in worn condition, and the dorsal plumage is nearly black, with a narrow edging of slaty gray. The April specimen is in fresh, unworn plumage, and is almost wholly deep slaty-gray above, with shaft-streaks and subapical blotches of black.

269. **Falco sparverius australis** *Ridgw.*—Represented by 40 specimens, 15 males and 25 females, taken as follows: January, 2; March, 2; April, 9; June, 3; July, 4; August, 7; September, 1; October, 8; November, 2; December, 2.

Of the 15 males, 6 show no rufous on the crown, and very few of the others show more than the slightest trace of rufous on a few feathers; in none does the rufous form a decided spot. Of the 25 females all but three have more or less rufous on the crown, it sometimes forming a large well-defined spot, but generally is restricted to very narrow streaks on a few feathers only.

Some of the March and April specimens, both males and females, show a strong wash of rusty buff over much of the ventral surface, varying in amount in different specimens, and wholly fading out later in the season. The width of the black bars on the back, and the amount of the black spotting and streaking below is subject to a wide range of individual variation. The intensity of the rufous above also varies greatly in individuals of the same sex taken at the same season; it also becomes much paler through fading towards the close of the breeding season.

270. **Elanoides forficatus** (*Linn.*).—Four specimens—October, 1; November, 3.

271. **Ictinia plumbea** (*Gm.*).—Represented by a series of 20 specimens, taken as follows: January, 1; August, 1; September, 7; October, 6; November, 3; December, 2.

272. **Gampsonyx swainsoni** *Vigors.*—Four specimens, taken one each in April, May, August and September.

273. **Leptodon cayennensis** (*Gm.*).—Two specimens—♂ ad., Sept. 4; ♀ juv., Nov. 20.

274. **Leptodon unicinctus** (*Temm.*).—One specimen, ♂ in transition plumage, Sept. 23.

275. **Ibycter americanus** (*Bodd.*).—One specimen, ♂ ad., Oct. 19.

276. **Milvago chimachima** (*Vieill.*).—Three specimens—♀ ad., Sept. 9; ♂ ad., Oct. 20; ♀ juv., Aug. 10.

277. **Polyborus tharus** (*Mol.*).—Three specimens—♀ ad., Feb. 21; ♀ juv., Aug. 15; ♂ juv., July 31.

278. **Gypagus papa** (*Linn.*).—One specimen, ♂ ad., May, 1883.

279. **Cathartes aura** (*Linn.*).—One specimen, "♀ ?," July 25.

280. **Ceriama cristata** (*Linn.*).—One specimen, ♂ ad., October.

281. **Columba speciosa** *Gm.*—Six specimens—four males, one female and one unfledged young, taken as follows: January, 1; September, 2; October, 1; November, 2.

282. **Columba rufina** (*Temm.*).—Five specimens, taken as follows: April, 1; September, 3; October, 1.

283. **Zenaida maculata** (*Vieill.*).—Two specimens—♂ ad., August; ♀ ad., July 15.

284. **Columbula picui** (*Temm.*).—The series of 12 specimens was taken as follows: May, 2; August, 5; September, 1; October, 1; November, 1.

285. **Columbula campestris** (*Spix*).—One specimen, ♀ ad., Cachoeira.

286. **Columbigallina griseola** (*Spix*).—One specimen, ♂ ad., July 22.

287. **Columbigallina talpacoti** (*Temm.*).—The 9 specimens —7 males and 2 females—were taken in January, 1; April, 3; June, 2; July, 1; September, 2.

288. **Peristera cinerea** (*Temm.*).—Four specimens—♂ ad., April, 7; 2 ♂ ad. and 1 ♀ ad., July 21–24.

289. **Engyptila erythrothorax** (*Temm.*).—Three specimens—♂ ad., March, 7; ♀ ad., September; ♀ ad., Oct. 30.

290. **Engyptila rufaxilla** (*Rich. & Bern.*).—Five specimens, of which 1 was taken in August, 2 in October, and 2 in November.

291. **Geotrygon montana** (*Linn.*).—Two specimens—♂ ad., Sept. 4; ♂ juv., Nov. 21.

292. **Penelope superciliaris** *Temm.*—Represented by 9 specimens, taken in August, September, October and November.

293. **Jacana jacana** (*Linn.*).—Three specimens—♂ ad., Oct. 2; ♀ ad., Feb. 15; ♀ juv., March 2.

294. **Vanellus cayennensis** (*Gm.*).—One specimen—♀ ad., Cuyaba, Dec. 5.

295. **Hoplopterus cayanus** (*Lath.*).—Two specimens, Cachoeira, Jan. 28, and Corumba, March 11.

296. **Charadrius dominicus** *Müll.*—Eleven specimens, taken Oct. 5 to Nov. 14, 1882.

297. **Ægialitis collaris** (*Vieill.*).—Corumba, Feb. 28 to April 1—7 specimens.

298. **Gallinago gigantea** (*Temm.*).—One specimen, ♀ ad., June.

299. **Gallinago frenata** (*Licht.*).—One specimen, ♂ ad., Nov. 1.

300. **Tringa fuscicollis** *Vieill.*—Three specimens, Oct. 6 and 21, 1882.

301. **Totanus solitarius** (*Wils.*).—This species seems to be almost a summer resident, the 11 specimens having been taken as follows: September, 3; October, 2; December, 1; February, 2; March, 2; April (April 10), 1.

302. **Bartramia longicauda** (*Bechst.*).—Chapada, 4 specimens, Sept. 26 to Oct. 27; Piedra Blanca, Bolivia, 1 specimen, April 23.

303. **Actitis macularia** (*Linn.*).—One specimen, Corumba, April 1.

304. **Aramides cayennensis** (*Gm.*).—Four specimens—May, September, and October.

305. **Rufirallus cayanensis** (*Gm.*).—Two specimens—♂ ad., May, 10; ♀ ad., Oct. 17.

306. **Ionornis martinica** (*Linn.*).—One specimen, ♂ ad., Cachoeira, June 30.

307. **Glaucestes parvus** (*Bodd.*).—One specimen, ♀ ad., Corumba, March 26.

308. **Theristicus caudatus** (*Bodd.*).—One specimen, ♂ ad., May 31.

309. **Tantalus loculator** *Linn.*—One specimen, ♀ ad., June 30.

310. **Ardea egretta** *Gmel.*—Two specimens, ♂ ad., Jan. 7; ♀ ad., Oct. 2.

311. **Ardea candidissima** *Gmel.*—One specimen, May 12.

312. **Butorides cyanurus** (*Vieill.*).—Three specimens—♀ ad., Cachoeira, Feb. 3; ♂ ad., Dec. 2; juv., Dec.

313. **Pilherodius pileatus** (*Bodd.*).—One specimen, ♂, December.

314. **Tigrisoma fasciatum** (*Such*).—One specimen, ♀ ad., Sept. 11.

315. **Cancroma cochlearia** *Linn.*—Two specimens, ♂ ad., June 18; ♀ ad., Oct. 10.

316. **Cairina moschata** (*Linn.*).—One specimen, ♂ ad., July 31.

317. **Anhinga anhinga** (*Linn.*).—One specimen, ♀ ad., Nov. 6.

318. **Colymbus dominicus** *Linn.*—Two specimens, ♂ and ♀, Sept. 19.

319. **Crypturus tataupa** (*Temm.*).[1]—Seven specimens, taken as follows: May, 1; August, 1; September, 3; November, 1; December, 1.

The November specimen is a downy chick; only a few days old. In coloration it has little resemblance to the adults. It may be described as follows:

Whole front of head, including lores and sides of the face in front of the eyes, brownish buff, the extreme tips of the downy fibres blackish, a narrow superciliary stripe, widening into a broad band behind the eyes, and a narrow stripe dividing the crown, and extending down the back of the neck, yellowish brown, like the forehead; sides of the crown and nape varied dark rusty brown and blackish; ear-coverts and a narrow maxillary stripe blackish; general color above rufescent dusky, the fibres of the downy feathers subapically ringed with pale buff; below, chin and throat grayish white, passing on the lower throat into a pale buffy tint; rest of the lower surface mixed buff and dusky, the downy feathers dusky and tipped with yellowish, passing into a rufescent buff posteriorly.

320. **Crypturus parvirostris** *Wagler.*—Four specimens—April, May, July and October.

321. **Crypturus undulatus** (*Temm.*).—Seven specimens, taken in February, May, October and November.

322. **Rhynchotus rufescens** (*Temm.*).—Seven specimens—♂ ad. and ♀ ad., Aug. 14; ♂ ad. and ♀ ad., Nov. 7; three young chicks, Nov. 9. The latter may be thus described:

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[1] The specimens of Tinamidæ have been kindly identified by Mr. P. L. Sclater, whose determinations are here adopted.

The head is striped rusty yellow and black, as follows : a broad black central crown stripe, separated from a much narrower lateral black stripe on each side by a narrow rusty yellow stripe ; this outer black stripe is succeeded laterally by a broad rusty yellow superciliary stripe, which is divided posteriorly by a narrow black stripe on the side of the head behind the eye ; a narrow black line above and below the auriculars, and a black maxillary stripe, extending on to the sides of the neck, all of the intervening space rusty yellow. General color above mottled yellowish white, rufous and black, the coarser bristly feathers being blackish subapically and each terminating in a pair of long rusty bristles; between the bristly feathers are softer more downy yellowish white feathers. Below, chin and whole throat white, passing into ochraceous over the breast and under surface generally, but paler behind the gular region.

323. **Nothura media** (*Spix*).—Two specimens — ♂ ad., Sept. ; ♀ juv., June 21.

324. **Rhea americana** *Lath.*—This species is represented by a single specimen, without data.

PART IV.—OÖLOGICAL NOTES.

A small collection of eggs, with a few nests, form part of the Chapada collection. The identity of the eggs was determined by the collector's number of the skin of the parent bird being marked on the label accompanying the eggs, and the accuracy of the determination of the eggs is thus assured with at least reasonable certainty. In a few cases the eggs were catalogued separately by the collector, and labeled merely with the vernacular names of the species. In all such instances, however, the eggs have been discarded as unidentifiable and worthless.

In the first part of this report the eggs were described in connection with the general remarks on the species. Later, however, it was thought better to bring the oölogical references together under a special subheading at the close of the more general part of the paper. In the following pages will be found descriptions of the eggs of the Chapada collection, with such notes as the collector chanced to record on the labels, except those of the Oscines, described in Part I of the present paper. For convenience a list of the species of which descriptions of eggs have been already given is here appended, with a reference to the page in Volume III, of this Bulletin where they are described:

Turdus albicollis, p. 341.
Turdus albiventer, p. 341.
Mimus modulator, p. 342.
Basileuterus flaveolus, p. 345.
Arbelorhina cyanea, p. 348.
Calliste margaritæ, p. 353.
Tanagra sayaca, p. 355.
Ramphocœlus atrisericeus, p. 357.
Tachyphonus rufus, p. 360.
Arremon polionotus, p. 363.
Saltator similis, p. 365.
Schistochlamys atra, p. 368.
Coryphospingus cucullatus, p. 371.
Zonotrichia capensis, p. 372.
Ammodramus manimbe, p. 374.
Ostinops decumanus, p. 376.
Cassicus persicus, p. 377.
Uroleuca cyanoleuca, p. 380.

Leptopogon amaurocephalus *Cab.*

The eggs of this species are pure white, and measure about .55 x .77 in. The collection contains three sets, taken Dec. 2 and 3, 1882. The seven eggs, marked as belonging to three sets, are unaccompanied by notes as to the character or situation of the nests.

Elænea pagana albiceps (*d'Orb. & Lafr.*).

Two eggs marked as belonging to No. 58,446, ♀, taken Oct. 21, 1882, are white with a slight creamy tinge, with a broad circle of very fine dark reddish brown and lavender dots about the larger end. The average measurements are .52 x .72 in.

Rhynchocyclus sulphurescens (*Spix*).

Two eggs of this species, belonging to different sets, are greatly elongated, measuring .67 x 1.00 in.; the ground color is dull reddish white, faintly blotched with brown, only a little darker than the ground color. The eggs were taken Nov. 1, 1883.

Myiobius nævius (*Bodd.*).

Two eggs labeled as belonging to this species, taken late in October, 1882, are deep creamy white, with a circle of pale reddish brown dots and blotches about the larger end. They measure .52 x .72 in.

Empidonax bimaculatus (*d'Orb. & Lafr.*).

This species is represented by a set of three eggs, taken Oct. 31, 1882. The ground color is rather strong buff, with heavy rusty brown blotches forming a broad ring around the larger end, mixed with a few smaller spots of lilac. Measurements, .55 x .74 in.

Metopia galeata (*Licht.*).

Two eggs of this species, taken Oct. 13, 1882, have a buffy white ground color, and are thickly covered by fine streaks and blotches of pale umber, which become massed in a broad zone around the larger end, nearly concealing the ground color. They measure .65 x .95 in.

Pipra fasciata *d'Orb. & Lafr.*

Two eggs of this species, marked as belonging to No. 58,513, ♀, taken Oct. 21, 1882, have a grayish white ground color concealed for the most part with longitudinal streaks and elongated narrow blotches of very dark purplish brown. Size, .62 x .83 in.

Furnarius albogularis (*Spix*).

There are 17 eggs of this species in the collection, belonging apparently to six sets, five of which have three eggs each and one has only two. They are unmarked, clear dull white, and vary considerably in size and shape. Extreme eggs measure .80 x 1.20 and .78 x 1.00, averaging about .80 x 1.05 in. They were collected Oct. 4–6, 1882.

Lochmias nematura (*Licht.*).

Two eggs of this species are plain soiled white, and measure .75 x 1.00. On the label is the following note by the collector: "Nest made in a hole in a small bank above a spring. Depth of hole, one foot. Nest composed of leaves of water plants. Oct. 28, 1882."

Another set of two similar eggs, badly incubated, belong apparently to the same species, the label of which bears the legend, "Nest composed of leaves of water plants in a hole 1½ feet deep, in a bank over a stream in forest."

Synallaxis azaræ *d'Orb.*

There are 8 eggs, in four sets of two each, marked as belonging to this species, taken in October, November and December, 1882. They are white, with a faint greenish creamy tinge, and average about .65 x .80 in.

One of the nests is described by the collector on the label as "composed of short, small dry sticks, 12 inches high, 8 inches wide, with a round entrance also of sticks, 9 inches in length."

Thamnophilus ambiguus *Swain.*

Two eggs of this species, taken Nov. 6, 1882, are dull white, rather profusely marked with streaks and blotches of purplish and lavender, except about the smaller end, where they are more sparsely distributed. Size, .63 x .84 in.

Thamnophilus radiatus (*Vieill.*).

Two eggs of this species, taken Nov. 6, 1882, have a general resemblance in style and markings to those of *T. ambiguus*; they are, however, much larger, and the ground color is more fully and evenly covered with rather finer markings. The grayish ground color is nearly concealed over the whole egg by fine stipplings and streaks of lilac and dots and scratches of blackish 'heliotrope purple.' Size, .67 x .93 in.

Phaëthornis pretrii (*L. & D.*).

A single nest of this species bears the following label: "Nest hanging by roots from roof of a small cave over a stream in a forest. Oct. 21, 1882." The nest is cornucopia-shaped, with the nest-cavity at the top. It has a vertical length on its convex side of 5½ inches, and of 4 inches on the shorter side. The depth of the cavity is 1½ in., and its diameter at top is about 1¼ in. It is a bulky, compactly felted structure, composed of fine vegetable material of a brownish color, and consists of what looks like fronds of a very delicate fern, mixed with silky fibers resembling spiders' silk. The pure white eggs measure .35 x .60 in. The collection also contains several clutches of eggs without nests.

Hemiprocne zonaris (*Shaw*).

Three eggs of this species average .96 x 1.45 in., and are soiled white. They were collected Oct. 25, 1882.

Cypseloides senex (*Temm.*).

An egg of this species, marked as belonging to skin No. 34,042, ♀, was collected Nov. 4, 1882. The collector has noted on the label: "Nest built of loose material, on a small rocky ledge, over which the water of a large stream fell. In the nest was one young bird and an egg." The egg measures .70 x 1.10 in., and is chocolate colored, doubtless from soiling.

Caprimulgus parvulus *Gould.*

The collection contains 10 eggs of this species, belonging apparently to five sets, taken in October and November, 1882. They are buffy white, sparingly but rather uniformly covered with small streaks and blotches of light and dark drab brown, and average about .80 x 1.05 in. The labels state that the eggs were placed on the bare ground in open clearings or at the edge of forests.

Nyctidromus albicollis derbyanus (*Gould*).

Nine eggs of this species, belonging to five sets, taken in September, October and November, vary in ground color from pinkish white to pinkish buff, well covered with small blotches of pale brown, varying from drab to pale reddish brown. They vary somewhat in size and shape, averaging about .87 x 1.24 in. "The eggs are laid on a few leaves or on the bare ground at the edge of a forest or by an open clearing." (Collector's notes on labels.)

Colaptes campestris (*Vieill.*).

The collection contains three sets of the eggs of this species, two of four each and one of six, taken in September and October. The labels read: "Eggs of Picapao do Campo. Found in cupim or white ants' nest. Nest in a large hole." One label states: "Male on nest, and caught by hand."

The eggs are of course glossy white; they average about .94 x 1.12 in.

Guira guira (*Gm.*).

One egg, "found in a nest built of sticks in campo. Height from ground, 2 metres. Several females are said to lay in the same nest until it is so full that the eggs roll off." (Collector's note on label.)

The egg is deep bluish green, overlaid by a network of whitish chalky streaks and blotches. Size, 1.18 x 1.63 in.

Ictinia plumbea (*Gm.*).

A single egg of this species was taken Oct. 6, 1882. The label reads: "On high tree, second branch; height from ground, 60 feet. Mother shot on the 6th, and on the 8th the male was found on the nest." The egg is soiled white, and measures 1.37 x 1.76 in.

Cariama cristata (*Linn.*).

There are two sets of the eggs of this species, one of two eggs taken Sept. 29, 1882, and one of three eggs taken Oct. 6, 1883. The eggs are dingy grayish creamy white, with a few small blotches and specks of russet brown. They average about 2.00 x 2.40 in. In size, shape and markings they much resemble the eggs of some of the species of *Buteo.*

The following is a transcript of one of the labels: "Seriema. On open campo in small valley. Nest situated on a tree some thirty feet high. The nest was about ten feet from the ground, built on three branches, and was two feet in thickness and two and a half in circumference, made of dry sticks, dirt, bark and weeds. Found male on nest."

Engyptila rufaxilla (*R. & B.*).

Two eggs of this species measure .85 x 1.15 in. "Called Turily." Collected Nov. 22, 1882.

Engyptila erythrothorax (*Temm.*).

Similar to the eggs of the preceding species, except perhaps slightly larger and more elongated. Size, .82 x 1.20.

Crypturus parvirostris *Wagl.*

Four eggs, labeled "Inambu—(No. of mother 2602" = Am. Mus. No. 34,888), average 1.15 x 1.50 in. The color is drab-gray, and while the surface is smooth it is much less highly polished than in the eggs of *Rhynchotus rufescens.* Collected Oct. 7, 1882.

Crypturus tataupa (*Temm.*).

Three eggs, labeled 'Inambu,' are doubtless referable to this species. They are a little larger and darker in color than those of *C. parvirostris*, but do not differ from them more than eggs of the same species often do. Size, 1.25 x 1.65 in.

Crypturus undulatus (*Temm.*).

Four eggs of this species average 1.60 x 2.00. The color is ecrú drab; the shell is smooth and polished but not as lustrous as in some other species of the family. The label reads: "Taca. Eggs on the ground in forest. No nest whatever. Nov. 2, 1882."

Rhynchotus rufescens (*Temm.*).

The collection contains four clutches of the eggs of this species, three of six eggs each and one of five. The eggs vary considerably in size, shape and color, the extremes in size measuring as follows: 1.60 x 1.95 and 1.85 x 2.25 in. An average egg measures 1.70 x 2.10 in. The color varies from reddish drab to dark slaty drab, and the surface of the shell is very highly polished. The following is a transcript from one of the labels: "Perdiz-grande. Found in cluster of grass behind a white ants' nest. No signs of nest, only a few feathers underneath eggs. Clutch, 5 eggs. Campo. Sept. 28, 1882." Another label has: "Eggs on bare ground in open campo. Clutch, 6 eggs. Nov. 29, 1882."

Article XI.—ANCESTORS OF THE TAPIR FROM THE LOWER MIOCENE OF DAKOTA.

By J. L. Wortman and Charles Earle.

In the present paper we propose to describe a genus of Perissodactyla new to America, namely, *Protapirus* Filhol, and also to add considerable knowledge respecting the structure of the genus *Colodon* Marsh.

The discovery of the occurrence of *Protapirus* in the upper part of the White River Miocene may be considered as one of the most interesting made by the expedition of 1892. It places the origin of the true tapirs, in this country at least, below the 'Oreodon Beds' of the White River Miocene, and nearly parallel stratigraphically with the European species of *Protapirus*.

In this paper we shall offer, first, a discussion of the various attempts which have been made to solve the problem of the origin of the tapir in America; second, a systematic description of the material relating to the American species of *Protapirus* and *Colodon*; and lastly, a review of the relationship between the American species of *Protapirus* and those found in Europe; including a *résumé* of the principal characters of the supposed Eocene ancestors of both the Tapiridæ and Helaletidæ.

Historical.—Prof. Marsh in his paper of 1877 on the 'Succession of Vertebrate Life in America' remarks: "The tapir is clearly an old American type;" he derives the genus *Tapirus* from *Hyrachyus*, saying that the tapir also passed in its evolution through the genus *Helaletes*. We shall show that at the present time these latter views have proved to be erroneous.

Prof. Scott[1] early attempted the solution of this problem; he also derived the tapir from *Hyrachyus*, placing the genus *Helaletes* (*Desmatotherium*) as a later stage in the evolution of this form. Profs. Scott and Osborn, in the 'Preliminary Report upon the Fossil Mammals of the White River Formation' removed the genera *Hyrachyus* and *Helaletes* from the line of the true tapir, and stated that this line has come down through genera with a trilobed last lower molar. They further remarked that the species of tapiroid called by Leidy *Lophiodon occidentalis* should be placed in the tapir line, and intermediate between the genera *Isectolophus* and *Tapiravus ;* they described *Isectolophus*, which they considered as one of the direct ancestors of the tapir.

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[1] E. M. Museum Bulletin of Princeton College, 1883, p. 46.

Prof. Cope[1] followed Prof. Osborn in his derivation of the tapir from *Isectolophus*, but he does not state definitely what he considers to be the earliest ancestor of the tapir.

In the 'Uinta Mammalia' Prof. Osborn more fully explained his reasons for placing *Isectolophus* in the line of descent leading to *Tapirus*, and also definitely stated that he believed *Systemodon* to be the earliest ancestor of the tapir in America. In one of the latest numbers of the Bulletin of this Museum,[2] Prof. Osborn gives more in detail his views as to the phylogeny of the Eocene Perissodactyla in America, and describes the various characters of the upper molars in the principal Perissodactyle phyla and how they may be distinguished from each other. These lines are considered by him to be : first, the *Systemodon-Isectolophus-Tapirus ;* second, the *Heptodon-Helaletes* (to which we may add *Colodon*) *;* and lastly, the *Hyrachyus-Triplopus-Hyracodon.*

In Europe Dr. H. Filhol has contributed greatly to our knowledge of the phylogeny of the modern tapir, through his discovery of the genus *Protapirus*, occurring as early as the Upper Eocene, in the Phosphorites of Quercy. We, however, strongly dissent from the view held by him, that *Protapirus* is identical with the American genus *Hyrachyus.* The conformation of the premolars, and of the external lobes of the superior true molars is very different in these two genera, and they belong in two entirely different lines of descent.

Lastly, another advance in the early history of the tapir in Europe has been made by Prof. Osborn,[3] who suggests that the species of *Lophiodon*, called by Rutimeyer *L. annectens*, is really a species of the American genus *Isectolophus.* If this supposition be correct, this will be the earliest European form known to belong in the line of the true tapirs.

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[1] American Naturalist, 1888, p. 994.
[2] Bull. Am. Mus. Nat. Hist., IV, 1892, p. 124.
[3] American Naturalist, 1892, p. 763.

TABLE SHOWING THE DISTRIBUTION OF THE TAPIRIDÆ AND HELALETIDÆ.

		AMERICA.	EUROPE.
LOWER MIOCENE.	Upper.	Protapirus obliquidens. Colodon occidentalis.	Protapirus douvillei.
	Middle.	Protapirus simplex.	
	Lower.		
EOCENE.	Upper.	Isectolophus annectens.	Protapirus priscus.
	Middle.	Helaletes boops. Isectolophus latidens. Heptodon calciculus.	Lophiodon (Isectolophus ?) annectens.
	Lower.	Systemodon tapirinus.	Palæotapirus.

Family TAPIRIDÆ.

Dentition : I $\frac{3}{3}$, C $\frac{1}{1}$, PM $\frac{4}{4}$ or $\frac{4}{3}$, M $\frac{3}{3}$. Premolars molariform or simpler in structure than true molars. Superior true molars with external lobes conical and equal in length ; metacone not flattened. Inferior true molars with crests transverse or oblique. Last lower molar with or without hypoconulid. Digits four-three.

The family Tapiridæ may be divided into two subfamilies; in the earlier subdivision, or Systemodontinæ, the premolars are simpler in structure than the true molars, whereas in the later forms, the Tapirinæ, or true tapirs, some or all of the premolars are molariform. The genus *Isectolophus* forms the transition stage between these subfamilies, as in it we have an increase in complexity of the posterior premolars; but *Isectolophus* still retains the large third lobe of the last lower molar, which is lost in the true tapirs.

Subfamily TAPIRINÆ.

Genus **Protapirus** *Filhol.*

Superior premolars with only one internal lobe. Inferior premolars with posterior crest undeveloped, tetartoconid distinct. Superior molars with metaloph oblique and shorter than protoloph.

The upper premolars in this genus are in some cases in a transitional stage of development as to the division of the internal cones, but in no case are these teeth as complex as the true molars. A very distinctive character of *Protapirus*, separating it from *Tapirus*, is the fact that the posterior crest of the inferior premolars is wanting, the talon having retained its primitive condition as to the separation of the internal from the external cone. The foot structure of the manus at least is nearly identical with that of the modern tapir.

Protapirus obliquidens, sp. nov.

Last two superior premolars with internal lobes notched at apex, first and second superior premolars with internal cone single. Second superior true molar with metaloph very short and oblique. Median valley of superior true molars not opening externally as in *P. priscus.*

The type specimen in the American Museum collection (No. 659) is a portion of a crushed skull which belongs to a young animal. In this specimen the maxillary dentition is partially preserved, but the individual was so young that the permanent dentition had not yet cut through. In the other specimens in the collection (Nos. 662 and 661), which we refer to this species, the lower jaw with nearly the complete dentition is present, and associated with it, is an upper true molar. Found in close proximity to these specimens was a complete manus; this latter specimen without doubt belongs to the same individual as the jaw.

Dentition.—The type specimen includes the four upper premolars and the second upper true molar. The first superior premolar consists of two external lobes, which are scarcely separated from each other. The internal lobe is single, and anteriorly this lobe is slightly extended transversely. As compared with the recent tapir this tooth has the internal lobe more developed than the external. In the tapir the external part of the first premolar is much extended transversely, and projects far beyond the limit of the internal lobe, whereas in *P. obliquidens* this extension of the external part of the tooth is not present. The three succeeding premolars have two well-developed external lobes; these are more flattened than in the recent tapir. In the type specimen of *Protapirus priscus* the internal lobe of the fourth superior premolar shows no sign of division; the case is otherwise with the species *P. douvillei* figured by Filhol.[1] In the type specimen of *P. obliquidens* the shape of the internal lobes of premolar 3 and 4 agrees with that of *P. douvillei*; and in these teeth we observe that the deuterocones are just commencing to indicate signs of division; the slight separation of this cone, however, is confined to the summit of the lobe. The second superior premolar in *P. obliquidens* has only one internal lobe, and this is not divided as in the two following teeth in this series. It has two small crests running outwards from the deuterocone. This tooth in the European species, *P. douvillei*, is more complex than in the White River form. In the former species pm. 2 has two small internal lobes, and from M. Filhol's figure we would conclude that these lobes are well separated. In the third and fourth superior premolars the anterior transverse crest is oblique, and abuts externally at the junction of the protocone with the protostyle. The posterior transverse crest of these teeth is straight and extends completely across the crown from

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[1] Ann. Sci. Geol., XVII, Art. 2.

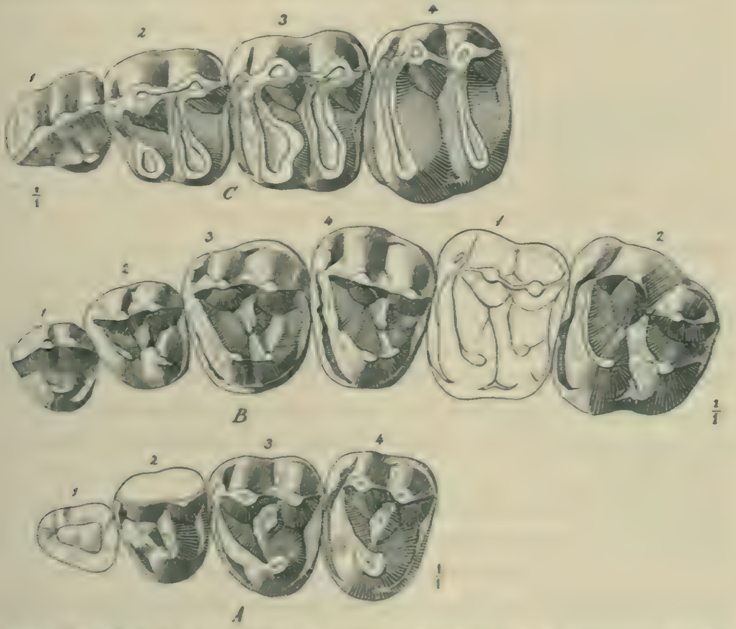

Fig. 1. Evolution of the premolars in *Protapirus* and *Tapirus*. *A*, *Protapirus simplex*, type; *B*, *Protapirus obliquidens*, type; *C*, *Tapirus americanus*.

the deuterocone to a point opposite the tritocone. The parastyle is not well developed on the superior promolars, and in only the last premolar is this lobe large; but in this case it is not separated from the anterior extension of the protocone.

In all the known species of *Protapirus* the posterior crest of the premolars is much shorter and straighter than the anterior. However, the anterior transverse crest is the first to appear; this is shown in the first premolar of *P. obliquidens.* In the second superior premolar of this species this crest is small, but increases much in size in the other premolars. It is interesting to note, that when we go back to the early ancestors of the tapir, we observe that the posterior crest of the posterior premolars arises by a transverse extension of the posterior intermediate tubercle. This conule first extends externally and joins the internal base of the tritocone; and then develops inwards and coalesces with the deuterocone. After complete fusion with this cone the latter begins to divide, and it is in this stage that we find all the deuterocones of the posterior superior premolars of *Protapirus obliquidens.* A better understanding of the growth of the posterior crest may be gained by studying the dentition of the early relatives of both the tapirs and rhinoceroses (*Systemodon* and *? Hyrachyus*).

The second superior molar of *P. obliquidens* is peculiar in having the posterior portion of the tooth much shorter transversely than the anterior part; this applies particularly to the metaloph, which is considerably shorter than the protoloph. The external part of the crown, or ectoloph, is oblique instead of straight as in the recent tapir; in this character the *P. obliquidens* agrees with the European species of *Protapirus.* The parastyle of the second superior molar is as high as the paracone and is very heavy; it abuts against the external convexity of the protoloph, although the latter is directly connected with the paracone and not with the parastyle. This is an important character in this species, as in the *P. priscus* of the Phosphorites, Filhol states that the anterior transverse crest is in contact externally with the parastyle. We may say, as a rule in the true tapirs, that the protoloph touches externally the paracone, but the *P. priscus* presents an exception to the rule. M. Filhol compares this character in the latter species with that of *Hyrachyus agrarius*, and concludes from the worn series of teeth, which he figures of *Hyrachyus*, that the protoloph in this genus is also continuous with the parastyle, but in this statement we believe he is mistaken. In all known species of *Hyrachyus* this crest touches the paracone.

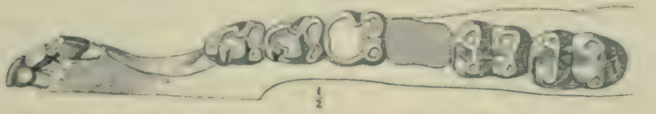

Fig. 2. *Protapirus obliquidens.* Crown view of lower dentition.

In the upper true molars of the tapir the parastyle is very large and well separated from the paracone, in contrast with that of *P. obliquidens* the summit of the paracone is high above the parastyle and is connected with the protoloph. This is the typical relation of these two elements of the crown in the modern tapir. The ectoloph of the second upper molar is oblique and has only a faint trace of a cingulum, agreeing in this repect with the European species from St. Gérand-le-Puy. The median valley is deep and its external termination has a prominent buttress. This portion of the valley does not open externally as in the Brazilian tapir and in the *P. priscus*, but is shut off by the crest connecting the paracone with the metacone. In contrast with the upper true molars of the tapir, we observe in this species the further extension of the metacone, and also the great development of the cingulum running externally from the hypocone. The last upper molar is somewhat larger than the second; otherwise its characters are similar. We note in this tooth a great shortening of its metaloph as compared with the length of the protoloph.

The lower jaw in the collection which we refer to *P. obliquidens* has the incisors smaller and more flattened than in *Tapirus americanus*; the crown of the median incisor is much depressed, and this tooth is larger than the others. The canine is a very small tooth as compared with that of the recent tapir. The length of the diastema behind the canine is large, being about two-thirds of that in the American tapir.

The inferior molar series, as compared with the size of the jaw, is larger than in the recent tapir. The three inferior premolars have large and heavy crowns. In the specimen being described these teeth are much worn ; however, the general form is the same as in the recent tapir, differing somewhat in the fact that the posterior crest on all the teeth is incomplete, the metaconid being distinct from the tetartoconid. The paraconid of the premolars was very large in the unworn tooth, and in front of this lobe was a small tubercle. The inferior true molars, like the premolars, have broad crowns ; the transverse crests of the same are low, the anterior having a prominent crest running inwards. As compared with the recent tapir the internal and external elements of the transverse crest are more strongly marked, and the interval on the crest connecting these latter is thinner than in the tapir's molars. None of the lower teeth have external cingula. The posterior cingulum of the last lower molar is small and limited to the median portion of the tooth.

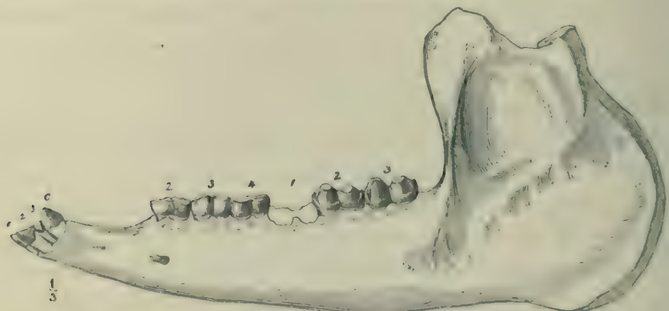

Fig. 3. *Protapirus obliquidens.* Side view of lower jaw.

Jaw.—The lower jaw of *P. obliquidens*, as compared with that of *T. americanus*, is more slender and elongated. The symphysial portion is shorter and strongly contracted at the diastema. The part of the horizontal ramus below the last molar is the heaviest portion of the jaw, and from this point the jaw tapers gradually to the incisive border. In the American tapir there is an angle of the jaw at the lower border of the ramus, just below the second premolar, and the symphysial portion is bent upwards from this point. The angle of the mandible is more pronounced than in the tapir's jaw, and is separated from the horizontal ramus by a concavity which is not present in the tapir. The mental foramina are two and are placed below the diastema.

Measurements of Protapirus obliquidens.

		M.
Length of superior premolars		.063
Superior premolar 4	trans.	.021
	antero-post.	.016
Superior molar 2	trans.	.022
	antero-post.	.020
Length of jaw		.260
" diastema		.038
" inferior molar series		.108
" true inferior molars		.060

Foot Structure.—The manus of *P. obliquidens* closely resembles in its general form and structure that of *Tapirus*, but it differs in some of the relations of the carpal elements, and the length of the digits to each other. The proportions of the carpus are the same as in the Brazilian tapir; the breadth being slightly greater than the height. It is surprising to find the manus of so early a form as *Protapirus* in such an advanced stage of displacement, and in this respect it resembles the foot of the existing American tapir. The lunar has only a small contact anteriorly with the magnum. The scaphoid nearly covers the whole superior surface of the magnum. The latter bone is higher and narrower than in the recent tapir. The unciform has the characteristic tapiroid shape, its height is greater than the breadth, and it has a large contact with the lunar. The trapezoid is high and narrow. The form of the trapezium is quite different from that of the American tapir. In *Protapirus obliquidens* it is a thick and heavy bone, having a triangular form; while in *Tapirus* this bone is elongate and slender. As we should expect to find in an early form like *Protapirus*, the proportionate lengths of the metacarpals are different from those of the recent tapir.

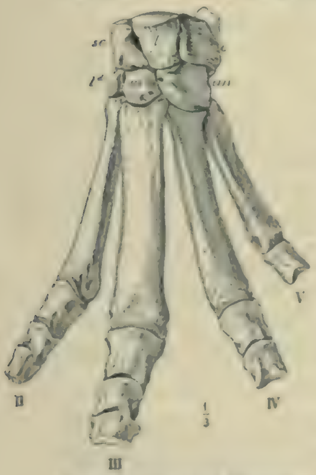

Fig. 4. *Protapirus obliquidens.* Anterior view of left manus.

The length of the fifth metacarpal as compared with the third is greater than in the recent forms.

The phalanges of the digits in this species are shorter than in the Brazilian tapir, giving the digits a short and heavy appearance. Two of the ungual phalanges are partially preserved, and these have the terminal portion incomplete. Earle has described elsewhere[1] the comparative evolution in the foot structure of the Brazilian and Malayan tapirs, and we will finally remark in closing the description of the manus of *Protapirus obliquidens*, that it is in about the same stage in reduction of the fifth digit as that of the *Tapirus indicus*, but more primitive than the foot of *T. americanus.*

Measurements of manus.

	M.
Total length of manus	.175
Breadth of carpus	.040
Length of carpus through magnum	.036
Length of metacarpal III	.100
" " V	.073
Lunar-unciform contact, trans.	.011

Protapirus simplex, sp. nov.

Internal lobes of all the superior premolars absolutely simple, showing no signs of division. Posterior transverse crest of all the superior premolars rudimentary.

This species of *Protapirus* is from an horizon of the White River formation lower down than that in which the *P. obliquidens* occurs. This division of the White River formation is called the 'Oreodon Beds,' and is separated from the upper, or 'Protoceras Beds' by a thick layer of barren clay. The character of the dentition of this species, as far as known, is much more primitive than that of the *P. obliquidens.* The type specimen of *Protapirus simplex* (No. 660) contains only the upper premolars of one side, and fragments of the lower jaw.

Dentition.—The crown of the first superior premolar is absent, its roots indicate that it must have closely resembled that of *P. obliquidens.* The internal cones of the remaining premolars are round and obtuse. These lobes are perfectly simple in structure, and are connected in front with an oblique transverse crest. In the second premolar the anterior crest is rudimentary; this tooth has however the posterior crest more developed than in the succeeding premolars. The external lobes of the last two premolars are round and obtuse, the protostyle is small and not as high as the protocone. In both these teeth there is a faint trace of an external cingulum at the postero-external border.

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[1] Science, March, 1893, p. 118.

The first two premolars of the lower jaw are partially preserved. These teeth are much smaller than those of *P. obliquidens;* they have elevated anterior crests. The posterior crest of the first premolar is nearly complete, but the tetartoconid is low and not well developed. Another fragment of the jaw of *P. simplex* contains the injured crowns of the first two molars. These teeth are of the same size as those of *P. obliquidens.* The depth of the jaw at m. 2 is equal to that of the larger species.

Measurements of Protapirus simplex.

		M.
Length of superior premolars		.054
Premolar 4	antero-post	.015
	trans	.020
Length of first two inferior premolars		.025

THE PHYLOGENY OF THE TAPIRIDÆ.

The earliest representative of the tapir line in the Eocene of America is the genus *Systemodon.* In the Wind River we see the first known departure toward the rhinoceros molar type in the genus *Heptodon*, which has a concave metacone; but in the latter genus this lobe is short and not longer than the paracone, as it is in the true rhinoceroses.

In *Systemodon* the inner lobes of all the superior premolars are absolutely simple. In the second premolar of this genus we see the first indication of the separation of the external lobes. The third and fourth upper premolars have a well-marked anterior transverse crest, but only on the last are there signs of the origin of the posterior crest. The characters of the superior molars in *Systemodon* are well adapted for further evolution into the true tapirine pattern; both external lobes are conical and of equal size, the parastyle being a very prominent element of the crown as in the tapir's molar. The shortening and obliquity of the metaloph is wanting, which is such a marked character of the upper molars of *Protapirus*. As pointed out by Prof. Osborn, the first inferior premolar in *Systemodon tapirinus* is placed just behind the canine, there being no diastema as in *Hyracotherium ;* this point he considers highly characteristic of the tapirs. The third and last inferior premolars in *S. tapirinus* have a deuteroconid, but the talon of the fourth is still in its primitive condition, in lacking the tetartoconid, which is so typical of the Bridger tapirs. The last lower molar has a large hypoconulid, and the crest of the inferior true molars are oblique, instead of straight as in the later forms.

There is a fragmentary example of the skeleton of *Systemodon tapirinus* in the American Museum collection, which indicates that this species was an exceedingly slender and agile form. The character of the pes is not exactly what we should expect to find in an ancestral form of the tapir. The calcaneum has a fibulo-calcaneal facet. The astragalus has a deep trochlear surface, with high condyles on each side. There is only a very slight contact between this bone and the cuboid. The metatarsals are long and slender. The internal and upper edge of the fourth metatarsal has a well-marked facet, which extends nearly across the surface of the bone. This facet is bordered above by the superior surface of the metapodial for the cuboid. The presence of this facet proves that *S. tapirinus* had a rudiment at least of a fifth digit.

We would suggest that the pes described by Marsh as belonging to *Eohippus* is possibly that of *Systemodon.*

The next stage in the evolution of the tapir is represented in the Bridger by *Isectolophus latidens* S. & O. The skeleton of this form is as yet unknown. The type was formerly referred by Scott and Osborn[1] to *Helaletes*, but is now placed in the genus *Isectolophus*. The above authors state in their first description of *I. latidens*, that the superior premolars are provided with only one internal cone, "which is joined by transverse ridges from the two outer cusps." In the type specimen of *I. latidens* the fourth inferior premolar is absent ; it was however probably nearly molariform in structure. One of the characters by which the upper true molars of *I. latidens* differ from those of the modern tapir, is that the protoloph is continuous with the parastyle and not with the paracone, as in the tapir's molar. The relations of this crest and tubercle are also variable in the European species of *Protapirus*, as shown by Filhol.

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[1] Bull. E. M. Mus. of Princeton College, 1878, p. 54.

The Uinta tapir is the *Isectolophus annectens*. It is very possible that the Bridger species referred by Scott and Osborn to *Isectolophus* may represent a different genus from the latter. In the type of *I. annectens* the upper premolars are wanting. The molars are exceedingly like those of the tapir, and they have the oblique ectoloph so characteristic of *Protapirus*. The shortening of the metaloph has not yet commenced in *Isectolophus*. The last inferior premolar of *I. annectens* is nearly molariform but still lacks the tetartoconid. The crests of the inferior true molars are nearly crescentoid in form, which character we should not expect to find in a Uinta tapir. The last lower molar has also a very large third lobe. Some of the characters above adduced as to the teeth of *I. annectens* may show by later discoveries that this species is not in the direct line leading to the true tapir. If the last two superior premolars are as complex in structure as the true molars, it will certainly have to be removed from the true tapirine line, as the earliest species of *Protapirus* in America has the internal cones of pm. 3 and 4 absolutely simple.

The structure of the carpus in *I. annectens* is exactly what we should expect to meet with in an early ancestor of the tapir. The distal facets of the lunar are nearly equal in extent, and as a result the lunar-magnum contact is much larger than in later forms of this line. The unciform is strongly tapiroid in its characters. The fifth digit of the manus is larger compared with the others than in the recent tapir. The cuboid of *I. annectens* is rectangular in form, closely resembling that of the tapir. The cuboid had a considerable contact with the astragalus.

We may add that the members of the subfamily Tapirinæ, or true tapirs, are found earlier in Europe than in America. The type species of the genus *Protapirus* was discovered by Filhol in the Phosphorites of Quercy; these beds correspond approximately with the uppermost or Uinta series of America. The genus *Palæotapirus* (which is very doubtful as to validity) comes from the Middle Eocene (Buchsweiler, Elsass). This formation is below the Phosphorites. The Phosphorite form of *Protapirus* is the most primitive in its dental characters; the last upper premolar in the type specimen has a simple internal cone, and shows no sign of division. The *Protapirus douvillei* is from the Lower Miocene of France (St. Gérand-le-Puy). This form exhibits a decided advance in the complication of the premolars, over the species from the Phosphorites. In the second upper premolar the two internal cones are complete; however, the third and fourth premolars are in a transition stage.

Turning now to the true tapirs in America we find, as already stated, that the earliest species is our *Protapirus simplex* from the Oreodon Beds of the White River Miocene. The structure of the last upper premolar in this species agrees closely with that of the tapir from the Phosphorites, but the development of the posterior transverse crest of the premolars is not as far advanced as in the European species. The latest known species of tapir in the Lower Miocene of America is our *P. obliquidens;* this form agrees closely in the structure of its superior premolars with that from St. Gérand-le-Puy, although the second premolar is not as much differentiated as in the latter species. The inferior premolars of *P. obliquidens* have not as yet completed their posterior crest; and the diastema of the jaw is still much smaller than in the recent tapir. As already shown in the description of the manus of *P. obliquidens*, it had become nearly as much specialized as in the American tapir.

The stages in the evolution of the tapir in America after the White River epoch are as yet not fully known. The genus described by Marsh called *Tapiravus* is from the Lower Pliocene. We have been unable to examine the specimen referred to this genus by Prof. Marsh, and cannot therefore state whether it is a true tapir, or an outcome of the family Helaletidæ.

SUMMARY.—The principal points brought out in the preceding description may be summarized as follows:

1. We consider the genus *Systemodon* as standing in ancestral relation to the Tapiridæ.

2. *Isectolophus latidens* is probably in the line leading to the true tapirs.

3. If further discovery shows that *I. annectens* has both the last two premolars as complex as the true molars, it must be removed from the main tapir line.

4. The earliest member of the subfamily Tapirinæ, or true tapirs, is found in the Phosphorites of France, there being a considerable interval between the latter formation and the Oreodon Beds of the White River Miocene.

5. In contrast with the other Perissodactyla of the White River formation, the premolars of *Protapirus* have not assumed the complexity of the true molars.

6. The foot structure of *Protapirus* is nearly as far advanced in its evolution as that of the existing American tapir.

Family HELALETIDÆ.

Superior molars lophodont, with metacone concave, and placed internal to paracone. External lobes of superior molars separated, with transverse crests of same complete.

This family, like the Tapiridæ, may be divided into the Helaletinæ and Colodontinæ. In the first subfamily the inferior dentition is complete, and the premolars are either simple in structure, or some of them have become molariform. In the Colodontinæ the lower external incisor is absent, and in this subfamily the feet are tending to monodactylism; which is proved by the increase in size of the median digit of the manus in *Colodon*, and the reduction in size of the fifth digit.

In contrast to the Tapiridæ, the Helaletidæ are confined to America, their nearest relatives in Europe being the family Lophiodontidæ. This group ranges in time from the Wind River Eocene (*Heptodon*) to the upper beds of the White River Miocene (*Colodon*).

Genus **Colodon** *Marsh*.

SYN.—*Lophiodon*, in part; *Mesotapirus* S. & O.

Dentition: I $\frac{3}{2}$, C $\frac{1}{1}$, PM $\frac{4}{3}$, M $\frac{3}{3}$. Last three superior premolars molariform; external lobes of superior true molars equal in size. Inferior premolars with two posterior cusps, but not connected by crests. Last lower molar with a third lobe.

The earliest notice of this genus is to be found in Dr. Leidy's Monograph on the 'Extinct Mammalia of Nebraska.'[1] The material upon which this description was based consist of a last lower molar which this author was unable to distinguish from that of *Lophiodon*, and therefore referred this specimen to that genus. Later Profs. Scott and Osborn,[2] in describing the affinities of the tapiroid genus *Isectolophus*, suggested that its Miocene successor was to be found in the species described by Leidy under the name of *Lophiodon occidentalis*, and that when the dentition was fully known it would be found to have two premolars like the molars. Upon this supposition they proposed the hypothetical name *Mesotapirus*, which proves to be invalid. In 1890 Prof. Marsh[3] attained additional material, by means of which he was enabled to point out the generic rank of this species, as well as the more important characters in which it differs from its nearest ally, *Helaletes*. As regards the species there appear to be at least two if not more represented in the material now known.

Colodon occidentalis *Leidy.*

SYN.—*C. luxatus* Marsh.

Root of lower canine round in section and placed close to incisor. Inferior premolars short and broad, with faint external cingula. Third lobe of last lower molar very small and conical in form.

Prof. Marsh's type specimen of *Colodon luxatus*, which he has permitted us to examine, is unfortunately not associated with any superior molars. Other specimens, however, in which parts of both series are present, render it quite certain that the upper premolars are complex like the molars. The specimens in the American Museum collection from the White River, which we refer to this species, consist of a finely-preserved lower jaw with all the molars intact, but lacking the crowns of the incisors and canines. Associated with this specimen and belonging to the same individual are parts of the skeleton, and also a beautifully preserved manus. A fragment of the superior maxillary bone bearing two molars is in the collection of Princeton College, and may represent another species. These teeth are rather small to be associated with the lower teeth above referred to.

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[1] P. 239, pl. xxi, figs. 28–30.
[2] Uinta Mammalia, p. 523.
[3] Am. Jour. Sci. and Arts, Vol. XXXIX, 1890, p. 524.

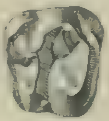

Fig. 5. *Colodon* (sp indet.). Crown view of a second superior molar. Natural size.

Dentition.—The most striking character of the upper true molars in *Colodon* is that the metacone is pushed in as it were, its external surface being concave, and placed well in from the paracone. The shape of the paracone is like that of the tapir's molar, and it has a small internal buttress. Both the paracone and metacone are of the same size longitudinally; the latter element is not so much drawn out as in the forms related to rhinoceros (*Hyrachyus*). The parastyle is strongly developed, and continuous internally with a slight anterior cingulum. The protoloph and metaloph are high and sharp. The anterior extension of the paracone is relatively much less in *C. occidentalis* than in *Protapirus obliquidens*. The obliquity of the metaloph is less than in the latter form. In contrast to the teeth of the true tapirs, we observe that the internal cones of the molars are not higher than the external. There is a slight postero-external cingulum on the superior molars in this species. In Prof. Marsh's description of *Colodon luxatus* he considers it to be without a lower canine. We think it more probable that the external incisor has been lost, and therefore believe that the outer tooth of this series is a canine. We may add that in the forms leading to *Titanotherium* (namely, *Palæosyops* and *Diplacodon*), the canine is retained while the external incisor is lost.

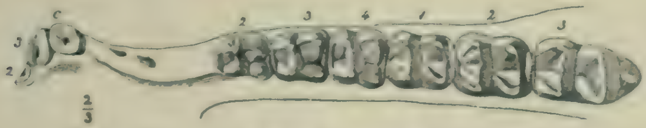

Fig. 6. *Colodon occidentalis.* Crown view of inferior dentition.

The roots of the incisors are much extended antero-posteriorly and larger than those for the canines. The latter teeth were smaller than the external incisors, and were separated by a large diastema from the second premolar. The inferior premolars are short and broad, with their posterior portion much wider than the anterior. The anterior crest of the second is notched. In the third and fourth premolars this crest is complete, but thick and depressed in the middle. The cusps of the talon of the inferior premolars are equal in height but unconnected, as in *Protapirus*. The transverse crest of the lower true molars is thinner and more slender than in *Protapirus*, and the spur extending inwards from the metalophid is less developed. The last lower true molar is larger than the others, its hypoconulid is small, and of a conical form. This lobe is situated at the postero-median part of the crown, and extends upwards nearly on a level with the posterior crest. Both the first and second lower true molars have a well-marked posterior cingulum. The lower jaw at the diastema is much contracted, the superior portion of the same is narrower than the margin bordering on the mental foramina.

Skeleton.—A nearly complete radius with the proximal part of an ulna is preserved. The former closely resembles that of the tapir, but it is shorter and more slender. The proximal trochlear surfaces are deep, that for the internal condyle of the humerus, as is usually the case with early forms, is oblique in position. The distal facets of the radius for the scaphoid and lunar are rather more pronounced than in the recent tapir. A distal portion of an ulna, showing a section of its shaft, is associated with this specimen. It is of great interest to note that the ulna is much reduced in size in *Colodon*, and agrees with the specialization in the manus of approaching monodactylism. The manus is much elongated and slender. The carpus is longer than broad, with its elements highly displaced. The lunar is high and narrow, with a large facet for the unciform which takes up its whole inferior face. The lunar-magnum facet is vertical in position and is continuous with that for the scaphoid. Anteriorly the lunar has a small contact with the magnum. Compared with the lunar of *Heptodon*, that of *Colodon* has its distal facets more unequal in size. In *Heptodon* these facets are nearly equal in dimensions, and the beak of the lunar is largely developed in that genus. The magnum of *C. occidentalis* is high and narrow, and it has a large articulation with the unciform. The shape of the latter bone is much like that of the true tapir, with its vertical axis greater than the transverse.

As compared with *Heptodon calciculus* the median metacarpal of *C. occidentalis* is larger than the others ; proximally it has a large contact with the unciform, but its articulation with mc. IV is reduced. The lateral metacarpals are very long and slender, and the diameter of their shafts, as compared with that of the third metacarpal, is much less. A peculiarity in the manus of this species in contrast with that of its supposed Eocene ancestor, *Heptodon*, is the great abbreviation of the length of the phalanges. In *Heptodon calciculus* the total length of the phalanges of the middle digit of the manus is fully three-fourths as long as their metacarpal, whereas in *Colodon occidentalis* the phalanges are very short, and their length is about three-eighths that of the median metacarpal. A marked character of the feet of *Heptodon* is the great elongation of the proximal phalanges. The fifth digit is not preserved ; however, from the size of the facet on the unciform for this metapodial, we estimate that it was much reduced, as compared with this digit in the Eocene ancestor of *Colodon*. There is only one podial element of the tarsus preserved, the astragalus. This bone closely resembles that of the tapir in its general form. The trochlear surface is rather broad and shallow ; the navicular face is much extended from above downwards, and convex. The astragalo-cuboid facet, unlike that of *Heptodon*, is elongated and extends anteriorly all across the anterior external margin of the bone. In this character the astragalus of *Colodon* resembles that of the true tapirs. The sustentacular and inferior facets of the astralagus differ from those of the tapir in being continuous, and at the junction of these two facets with that for the cuboid there is a prominent ridge. In *Heptodon* these facets are continuous, but in *Helaletes boops* Marsh they are discontinuous.

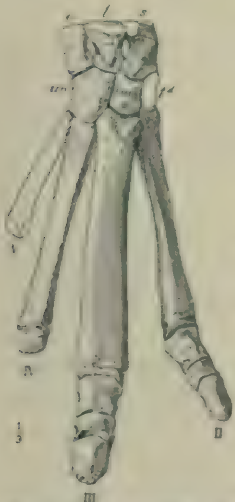

Fig. 7. *Colodon occidentalis.* Anterior view of right manus.

We may say that, as a whole, the foot structure, especially of the manus of *Colodon occidentalis*, is more specialized than its contemporary *Protapirus obliquidens ;* this is shown by the small size of the lateral digits, and the reduction of the ulna.

Measurements of Colodon occidentalis.

	M.
Total length of radius	.195
Breadth of distal extremity	.031
" " " of ulna	.013
Total length of manus	.183
Length of lunar	.021
Breadth of unciform—mc. V facet	.007
Length of astragalus	.036
Breadth of trochlear of same	.026
Total length of inferior molar series	.080
Length of inferior premolars	.032
" last inferior molar	.019
Breadth of jaw between canines	.016

ANCESTORS OF COLODON.

The earliest known genus in the Eocene, which can be referred to the ancestor of *Colodon*, is considered by Prof. Osborn to be *Heptodon*. This genus was first placed by Prof. Cope as ancestral to the Rhinoceros series. The species of *Heptodon* whose structure is best known is the *H. calciculus* from the Wind River. The osteology of this species has been quite fully described by Osborn and Wortman,[1] and it remains for us to compare the characters of *H. calciculus* with those of *Colodon occidentalis*, and also with the Bridger representative of this line, namely, *Helaletes*.

In both the upper and lower dentition of *Heptodon calciculus* there is a long diastema behind the canines. The first premolar in both jaws is placed close to the second ; while in the true tapirine line this tooth, as shown by Prof. Osborn, is situated next to the canine. The internal lobes of the superior premolars show no signs of division, the second superior premolar has only one external lobe, whereas in *Systemodon* this lobe is nearly double. The characters of the external lobes of the superior true molars in *Heptodon* are very important in diagnosing this line of descent. In *Systemodon* we have seen that both the external lobes of the ectoloph are equal in size, and conical in form. In *Heptodon* the metacone has become strongly bent inwards and lengthened ; the extent of this lobe however is not greater than the paracone. The separation of the external elements of the crown of the upper true molars in *Heptodon* is nearly as great as in *Systemodon*. The inferior premolars of *Heptodon calciculus* are very primitive in form ; the first and second are simply slender cones. The third and fourth lower premolars have low and broad heels, and the fourth has a well-marked anterior crest. The lower true molars are high and compressed, their crests are slightly oblique ; the spur extending from the anterior crest is not as well marked as in *Systemodon*. The last lower molar has a small conical hypoconulid.

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[1] Bull. Am. Mus. Nat. Hist., Vol IV, 1892, p. 127.

The foot structure of *Heptodon calciculus* is rather more specialized than that we should expect to find in an ancestor of *Colodon*. The great compression and elongation of the manus and pes is a marked character of *Heptodon*. However, there is a close resemblance between the form of the lunar of *Heptodon* and that of *Colodon*. The enlargement of the median digit of the manus of both of these genera is to be observed, but in *Colodon* the phalanges are short and heavy ; whereas in *Heptodon* they are very long and slender. Comparing the astragalus of *H. calciculus* with that of *C. occidentalis*, we find some difference in the relations of this bone with the cuboid. In the former genus, as we have seen, the astragalo-cuboid contact is very small and confined to the posterior aspect of the tarsus, but in *Colodon* this contact is a large one, and extends all across the antero-external surface of the bone, as in *Tapirus*. We must therefore suppose a great spreading and widening of the tarsus of *Heptodon* and as a result a large astragalo-cuboid contact, to lead up to the condition found in *Colodon*.

The connecting type between *Heptodon* and *Colodon* is now considered to be the genus *Helaletes*. In this form the last two superior premolars have become molariform in structure. In the second superior premolar we remark that the external lobe is double, an advance in structure over the condition of this tooth in *Heptodon*. The internal buttress of the upper true molars of *Helaletes* is large, and the parastyle has increased in size in contrast to that of *Heptodon.* In the lower jaw of *Helaletes* the first premolar has been lost, and the third and fourth are nearly as complex in structure as the true molars. The diastema of the jaw is long in this genus, and shows a marked increase in size over that of *Heptodon.* Prof. Osborn has shown that the presence of the hypoconulid on the last lower molar of the different species of *Helaletes* is a variable character. Now in *Colodon* this lobe is small, but well marked. In *Helaletes boops* Marsh there is a small hypoconulid, whereas in *H.* (*Dilophodon*) *minusculus* Scott this lobe is absent. We believe, therefore, the *H. boops* was probably ancestor of *Colodon,* but that the *H. minusculus* approaches *Hyrachyus* in the loss of the hypoconulid.

The known material pertaining to the genus *Helaletes* is too insufficient to enable us to trace the stages in the reduction of the lateral incisor of *Colodon.* In *H. boops* (syn. *H. nanus* Leidy) the alveoli for the lower incisors are all nearly equal in size. The canines in this species were much larger than the incisors, this being in marked contrast with those of *Colodon occidentalis.* In conclusion, we think that the discovery of more material referable to *Helaletes* will clear up many points in the evolution of the *Heptodon-Colodon* line which are now in obscurity. In fact all the known species of both *Systemodon* and *Heptodon* are extremely slender forms as compared with their supposed Miocene successors, and if we derive the true tapirs and pseudo tapirs from any of the known species of either of these genera we must suppose a considerable modification of their foot structure to reach the condition found in their Miocene relatives. The dentition of these early Wahsatch and Wind River tapiroids, however, is well adapted for further evolution into later Miocene types, but in their foot structure we find it otherwise.

Article XII.—ON A COLLECTION OF MAMMALS FROM THE SAN PEDRO MARTIR REGION OF LOWER CALIFORNIA, WITH NOTES ON OTHER SPECIES, PARTICULARLY OF THE GENUS SITOMYS.

By J. A. ALLEN.

The present paper is based on about 250 specimens collected by Messrs. E. C. Thurber and A. W. Anthony, chiefly during the month of May (April 30 to June 6), 1893. The bulk of the collection was made in the San Pedro Martir Mountains, but a few were taken at various points on the journey between San Diego, California, and San Pedro Martir. Through arrangements made before the expedition was undertaken, the entire collection of mammals obtained has been secured for the Museum. As would be expected, the collection is made up largely of a few common species (one-half of the specimens consist of a single species each of *Sitomys* and *Tamias*), but it contains, in all, representatives of 20 species, all but four or five of which are fairly well represented. Four are apparently new, namely, two species of *Sitomys*, one of *Tamias*, and one of *Scapanus*.

The general character of the country between San Diego, the starting point, and San Pedro Martir, is well known to be similar to that of the immediately adjoining portion of southern California. The San Pedro Martir Mountains, the objective point of the expedition, and where most of the collection was made, are thus described by Mr. A. W. Anthony: "About one hundred and fifty miles south of the United States boundary, and midway between the Pacific Ocean and Gulf of California, lies a range of mountains, which is marked upon the later maps of the peninsula as 'San Pedro Martir.' The region embraces a series of small ranges which rise from an elevated *mesa*, having a mean elevation of about 8000 feet, and an extent of sixty by twenty miles. In these mountains are born the only streams that this part of the peninsula affords, and an abundance of pine timber is found throughout the region. Many of the ranges on the eastern side of the San Pedro Martir rise to an elevation of 11,000 feet, or even, in one or two places, to 12,500 (?) feet.

"Arising as the region does from the dry, barren hills of the lower country to an elevation higher than any other on the peninsula or in southern California, and presenting in its alpine vegetation and clear mountain streams features so different from the dry manzanita and sage-covered hills of the surrounding country, it is not unnatural to suppose that its animal life would be found to differ in some respects from that of the surrounding hills. It was not, however, until I had been in Lower California over two years that I was able to visit the locality and give it a little of the attention it deserves."[1]

Mr. Thurber informs me that the route taken was that of the old stage road from Tia Juana (the custom house, sixteen miles south of San Diego) to Ensenada, and thence by a poor wagon road to Colnett, on the coast, about 100 miles south of Ensenada, and about due west of the San Pedro Martir. The principal localities at which specimens were taken are the following: Carriso Creek, in a small valley about 22 miles south of Tia Juana; Gato Creek, 36 miles south of Tia Juana; Ensenada, 50 miles south of Tia Juana; Guadaloupe Valley, 35 miles south of Ensenada; Salado Cañon, 15 miles north of Colnett; Cape Colnett, on the coast; San Telmo and Valladares, about 45 miles east of Colnett, and near the western base of the San Pedro Martir.

From Mr. Thurber's letters I extract the following, as well as the few field notes given in the following list of the mammals taken on the expedition: "On the west the San Pedro Martir Mountains drop off by a series of benches, 300 or 400, to about 1500 feet in height. I think we went up six of these benches before we reached 'La Grulla' (a large meadow, about three miles long, where we made our third camp); from there to our last camp was about three miles, with a gradual rise of about 300 feet. From our last camp it was about two miles to a pass in the hills from which we could look down into the Gulf of California, distant about 25 miles. The eastern slope was very different from the western—quite precipitous, but broken up by 'hog-backs' running down six or eight miles. At the eastern foot is one of the most barren of deserts, cut off from the shore by a range of low, desert mountains. Our first and second camps were made on the second and fourth benches, respectively. Encautado Peak was about ten miles northwest of our last camp. The mountains themselves are rather barren—rocky in the extreme, with very little water."

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[1] Proc. California Acad. Sci., 2d Ser., Vol. II, 1889, p. 73.

In working out the forms of *Sitomys* it became necessary to give some attention to the group as a whole as represented in the region immediately to the northward. In this connection I am indebted to the kindness of Mr. F. W. True, Curator of the Department of Mammals in the United States National Museum, for the opportunity to examine the types of the species described by Professor Baird in 1855-57, and other historic material used by the same author, and later by Dr. Coues. These include the the types or co-types of Baird's *Hesperomys eremicus*, *H. gambelii*, *H. boylii*, and *H. austerus*, the relations and characters of which it was important to establish, in relation not only to the present collection, but for the proper determination of several hundred specimens of the genus received during recent years at the Museum from various parts of California.

I am also indebted to Professor Charles H. Gilbert, of the Leland Stanford Junior University, Palo Alto, California, for the loan of the entire series of the specimens of *Sitomys* contained in the collection of the University. They have proved of special interest and value, coming as they do mostly from the vicinity of the coast region of central California, which includes the type localities of both *S. californicus* (Gambel) and *S. gambelii* (Baird). This collection was also unexpectedly found to include a considerable series of specimens of a species of this genus thus far undescribed.

1. **Thomomys fulvus** (*Woodh.*)—Eleven specimens, San Pedro Martir, at altitudes varying from 7000 to 8200 feet; Gato Creek, one specimen.

These specimens are instructive as showing variations due to age, in respect to both coloration and cranial characters. Most of the specimens are middle-aged or rather young, but several of the others are very old. The former present the usual coloration of *T. fulvus* from Arizona and southern California generally; the others are much paler and grayer, with a rather distinct dusky median dorsal streak, one of them presenting a striking resemblance to average adult examples of *T. bottæ.* In respect to the skull, the younger and middle-aged specimens present the usual rather small quadrate interparietal so uniformly characteristic of *T. fulvus;* in the old specimens the sutures become less distinct, and strong ridges for muscular attachment begin to arise on the sides of the cranium, moving inward toward the median line as they increase in size, till finally they not only encroach upon the lateral borders of the interparietal, but extend inwardly much beyond its outer border. In the oldest specimen they nearly meet on the median line of the skull, and all trace of the interparietal as a distinct bone is lost, except for a slight indication of the suture on its front border. The skull is of course large and massive (total length, 48 mm., greatest zygomatic breadth, 26, as against 39.6 and 23.6 respectively for an average middle-aged adult). The peculiar coloration and the apparently small interparietal at first gave the impression that the series contained two very distinct species, but a detailed study of the skulls when properly cleaned shows that the peculiarities of two or three of them, as compared with the others, are due to old age.

2. **Perodipus agilis** (*Gamb.*).—Eight specimens, taken at Ensenada, Valladares and Gato Creek, May 29 to June 6. According to the measurements on the labels the 7 adult specimens vary as follows:

Sex,	♂	Total length,	248	mm.	Tail vertebræ,	171	mm.
"	♂	"	264	"	"	143	"
"	♂	"	270	"	"	154	"
"	♂	"	288	"	"	165	"
"	♂	"	315	"	"	187	"
"	♀	"	233	"	"	163	"
"	♀	"	284	"	"	175	"

3. **Perognathus fallax** *Merriam.*—Four specimens, taken at the following localities: Cape Colnett, June 1; Guadaloupe Valley, June 5; Gato Creek, June 6.

4. **Arvicola edax** *Baird.*—Three specimens, one male and two females, fully adult, San Pedro Martir, altitude 8500 feet, May 26.

These specimens are provisionally and with much hesitation referred to *Arvicola edax* as defined by Baird, whatever the previously described *A. edax* of Leconte may have been. They are very pale yellowish gray above, slightly varied with blackish; below, lustrous silvery gray. Tail very scantily haired, a little darker above than below. These specimens are paler even than a series from Santa Ysabel, San Diego Co., Cal., but as the latter were taken in December, the difference may be in part seasonal.

Respecting these specimens Mr. Thurber writes me as follows: "*Arvicolæ* were common in one large meadow on the extreme eastern side of the mountains, but either our traps were too weak or we did not have the right bait, as three were all we could get, and those were caught the first day traps were put out. There were three large colonies in this meadow, and judging from the number of holes and runways there must have been a couple of hundred in each."

5. **Neotoma fuscipes** *Cooper*.—One ♀ ad. and two quarter-grown young, San Pedro Martir, altitude 8200 feet, May 18. The old female is marked "Parent of the young; nursing teats $\frac{2}{2}$." These specimens agree very well with specimens from southern California (San Diego and San Bernardino Counties) which I provisionally refer to this species.

Mr. Thurber's notes state: "*Neotoma* not common. In smoking a bee-hive, the smudge was accidentally dropped into a rat's nest, and a female ran out with two young clinging to her and were secured by Mr. Anthony at one shot."

6. **Sitomys americanus thurberi,** subsp. nov.

Above grayish fulvous, strongly varied with black, the prevailing tint being often decidedly blackish, but without any well-defined darker dorsal area along the median line of the back; sides rather more fulvous, but without a distinct fulvous lateral line; whole lower surface and both fore and hind feet to considerably above the carpal and tarsal joints pure white, this color abruptly defined on the sides against the darker color of the upper parts. Ears dusky, with a narrow whitish rim, nearly naked, but with a prominent lanuginous tuft at the anterior base, colored like the fur of the surrounding parts. Posterior half of the soles very scantily furred for a member of the *americanus* group. Tail sharply bicolor, grayish white below, blackish above, thinly haired and with a slight terminal pencil; tail vertebræ considerably less than half the total length.

Measurements.—Total length, 160 mm.; tail vertebræ, 75 (average of 43 specimens measured in the flesh by the collectors); ear from crown, 13.5; ear from notch, 16; hind foot, 20 (last three measurements from skins).

Skull, total length, 26 ; basilar length, 22 ; greatest zygomatic breadth, 12.7.

Type, No. $\frac{6234}{4871}$, ♂ ad., San Pedro Martir Mountains, Lower California, altitude 8200 feet, May 20, 1893 ; coll. E. C. Thurber, after whom this subspecies is named.

Young (about two-thirds grown) are pale plumbeous gray, strongly varied with black above ; below, pure white, with a tinge of plumbeous, due to the plumbeous basal portion of the fur tinging the general color of the surface.

Sitomys americanus thurberi is based on a series of about 70 specimens, collected in May, 1893, by Messrs. E. C. Thurber and A. W. Anthony, in the San Pedro Martir region of Lower California. The series shows considerable variation in coloration, a small proportion of the specimens tending more or less strongly toward *S. americanus sonoriensis*, and a small number of others towards *S. a. gambelii*. In other words, about one specimen in ten shows a strong suffusion of fulvous pervading the whole dorsal region ; a much smaller proportion present a slightly reddish or bay tinge. The younger specimens, though adult in size, are rather light gray, faintly suffused with pale fulvous, and strongly varied with black.

The strong feature of this well-marked form is the pale grayish fulvous of the upper parts strongly varied with black. In the large admixture of black hairs in the dorsal surface, and somewhat in other features, this may be considered as a parallel form in the *americanus* group to the *fraterculus* form of the *eremicus* group of the same general region.

A large series of *Sitomys* in the Museum collection from Santa Ysabel, San Diego Co., Cal., collected by Mr. F. Stephens, are fairly intermediate between *sonoriensis* and *thurberi*, and seem almost distinct enough from either to require a name, but for the present are provisionally referred to *sonoriensis*.

7. **Sitomys californicus** (*Gambel*).—One specimen, a nearly adult female, San Pedro Martir (altitude 4300 feet), May 5, 1893.

Through the kindness of Prof. C. H. Gilbert of the Leland Stanford Junior University, I have before me a series of 9 specimens of *S. californicus* from San Mateo and Santa Clara Counties, California, and hence from near the type locality (Monterey) of the species. There are also in the Museum collection 11 specimens from Santa Ysabel and 12 from Dulzura, in San Diego County. The southern specimens seem at first sight a little darker and somewhat smaller than the northern, but the series are too small to be decisive. It is to be noted, however, that 7 out of 9 northern specimens have the tail conspicuously tipped with white, the amount of white varying from a slight pencil to a tipping of three-fourths of an inch, while of the 23 southern specimens only *one* has the tail tipped with white. The measurements, as given by the collectors on the labels, and selecting only the fully adult specimens from each series, average as follows:

	No. of spec.	Total length.	Tail vert.	Collector.
San Mateo and Santa Clara Counties.	4	247	131	Gilbert and Price.
Dulzura, San Diego County...	8	245	135	Chas. H. Marsh.
Santa Ysabel, San Diego County.....	7	229	129	F. Stephens.

I am informed by Mr. Stephens that Dulzura and Santa Ysabel are practically similar as regards physiographical conditions, Dulzura being about thirty miles south of Santa Ysabel, a little nearer the coast, and at a slightly higher altitude.

8. Sitomys fraterculus (*Miller*). — Five specimens, San Pedro Martir, altitude 8200 feet, May 13–16, and one specimen, Valladores, altitude 2500 feet, May 30.

These specimens do not appear to differ appreciably from a large series from Santa Ysabel, San Diego Co., Cal., situated about 30 miles north of the type locality of the species.

9. **Sitomys martirensis**, sp. nov.

Similar in coloration and in the size and character of the ears to *S. truei*, but with longer tail and less heavily-clothed soles. Above grayish fulvous or pale yellowish brown, finely varied with blackish; sides washed with bright tawny, forming a broad lateral line. Below pure white, the basal portion of the fur blackish plumbeous, with sometimes a wash of tawny on the middle of the breast. A narrow blackish eye-ring; feet white to above the carpal and tarsal joints; ears dusky, nearly naked; tail sharply bicolor, above blackish (in one specimen intense black), grayish white below, well haired and terminating in a heavy pencil, the vertebræ alone rather longer than head and body.

Measurements.—Total length, 195 mm.; tail to end of vertebræ, 102 (average of 4 specimens measured by the collector before skinning); terminal pencil, 5 ; ear from crown, 16 ; ear from notch, 20 ; hind-foot, 22 (last four measurements from the skins).

Skull, total length, 28 mm. ; basilar length, 23.4 ; greatest zygomatic breadth, 12.7.

Type, No. $\frac{6815}{4949}$, ♀ ad., San Pedro Martir Mountains, altitude 7000 feet, May 8, 1893, coll. A. W. Anthony.

This species is based on four specimens, two males and two females, all fully adult, collected in the San Pedro Martir Mountains, at an altitude of 7000 feet, May 6, 1893, by Mr. A. W. Anthony. They are very uniform in size and coloration.

Sitomys martirensis apparently finds its nearest relative in *Sitomys megalotis* (Merriam), which it closely resembles in size and coloration, but has smaller ears.

Another large-eared species of *Sitomys*, as yet undescribed, is represented by a series of 18 specimens from San Benito Co., California, mostly from Bear Valley and Mount Hamilton, kindly loaned me for examination by Prof. C. H. Gilbert from the collection of the Leland Stanford Junior University. Fourteen of them are fully adult and four are young. By the courteous permission of Prof. Gilbert I subjoin the following description :

Sitomys gilberti,[1] sp. nov.

Similar in size and proportions to the preceding (*S. martirensis*), but much darker in coloration. Above dark yellowish brown, strongly varied with blackish ; sides more strongly washed with fulvous, with a deep fulvous lateral line separating the white of the lower parts from the dark color of the upper surface, in some (November) specimens this line taking on a strong salmon tint. Below white ; with (in some specimens) a more or less distinct wash of salmon across the breast ; fore feet white as far as the wrists, and the hind feet nearly or quite to the tarsal joint, the dark color of the dorsal surface usually reaching the joint and sometimes extending slightly on to the upper surface of the foot proximally. A rather distinct blackish eye-ring, in some specimens very pronounced ; ears dusky, thin, papery, and nearly naked ; soles nearly naked to the heel ; tail rather scantily haired and with a thin pencil at the tip, distinctly bicolor, the upper surface varying in different specimens from dusky brown to blackish or even black, the lower surface dull whitish, varying to nearly clear white.

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[1] Named for Professor Charles H. Gilbert, the eminent ichthyologist, who is of late devoting much attention to the study of California mammals, and to whom I am greatly indebted for the loan of material in the present connection.

Measurements (average of 11 adults, from measurements taken by the collector before skinning).—Total length, 190 mm.; tail vertebræ, 98; "ear," 22; hind foot, 23.

Skull, total length, 28 mm.; basilar length, 23.4; greatest zygomatic breadth, 12.7.

Type, No. 329, Leland Stanford Junior University, ♂ ad., Bear Valley, San Benito Co., Cal., April 1, 1893, coll. C. H. Gilbert and W. W. Price.

The *young* are blackish plumbeous above, pure white below, the dark color of the upper parts extending slightly past the tarsal joint on the hind feet. Later the sides become yellowish gray or grayish fulvous, brighter or clear fulvous at the lower edge adjoining the white of the lower parts.

Sitomys gilberti is in many respects a miniature of *S. californicus*. Although only about half the size of *S. californicus* (as regards actual bulk), it closely resembles it in coloration, comparing adults of corresponding season, or young of corresponding ages, although *californicus* will average much darker, and has a nearly unicolor tail. The dusky color of the upper parts extends similarly in both to or a little beyond the tarsal joint, and both have enormously large ears. The real relationship of *S. gilberti* is with the *S. truei* group, of which it is obviously a component, and its nearest affine is apparently *S. martirensis*, which it closely resembles in size and proportions, but from which it differs in many details of coloration.

Among the specimens of *Sitomys* loaned me by the United States National Museum for use in the present connection, is one specimen (No. 4706) from "California" referable to this species—the only specimen I have yet seen except the series above mentioned from San Benito County, on which the species is based. It is not quite adult, but is strictly comparable with several specimens in the San Benito series. This specimen is of special interest on account of the inscriptions on the labels attached to it. It appears to have been originally identified as "*Hesperomys californicus*" by Major Leconte, from whom the specimen was received. Dr. Coues has labeled it "*Hesperomys leucopus?*" but on the back of his label he has written "*californicus* apud Lec. nec Bd. Probably = *gambeli* Bd." And then later in pencil "near *aztecus* Sauss." Thus Dr. Coues recognized it as something out of the usual run of California *Sitomys*, and in his later opinion, in considering it "near *aztecus*," suggested its true affinities.

Having lately made a study of the types and other extant material on which Baird based his three West Coast species of *Hesperomys*, namely *austerus*, *boylii* and *gambelii*, a few words on these forms may not be out of place. First as to the southern form, *gambelii*.

Sitomys americanus gambelii (*Baird*).

Hesperomys gambelii Baird, Mam. N. Am. 1857, p. 464. Type from Monterey, Cal.

Hesperomys gambelii Baird was based primarily on two mounted specimens (Nos. $\frac{368}{1282}$ and $\frac{369}{1283}$) from Monterey, California, of which No. 369 should probably be regarded as the type, as it is the only specimen specifically mentioned in the original account of the species. This specimen, Mr. F. W. True informs me (in a letter dated June 8, 1893), is not now extant, and has not been in the collection for many years. No. 368, which may be considered as a co-type, is, through the kindness of Mr. True, now before me. It is, however, almost valueless for purposes of comparison, having become greatly faded from long exposure to light as a mounted specimen; it has also lost its ears, and is in a sad plight generally. The color above is now brownish yellow, and the tail is uniform pale yellowish buff—not bicolor. This is the only skin extant positively referred by Baird in his original account of the species to *H. gambelii*. A single skin from Santa Barbara (No. 7184), labeled sometime later by Prof. Baird as "*Hesperomys gambelii*, juv.," is a youngish adult of the common short-tailed Santa Barbara style of *Sitomys a. sonoriensis*. His No. 810, from Astoria, Oregon (also before me), referred doubtfully by Baird both to *H. gambelii* and *H. boylii*, I should refer to *S. a. austerus*. Some "Posa Creek, Cal.," specimens he also referred provisionally to this species. A skin (No. 284) from San Francisco, an alcoholic series of six specimens from Petaluma, and an alcoholic series of four specimens from Tomales Bay, were, however, also positively referred by Baird to *H. gam-*

belii. It is safe therefore to consider Monterey[1] as the type locality of *H. gambelii*, and that the vicinity of Monterey and the region thence northward along the coast to Tomales Bay, forty miles north of San Francisco, are within the area of typical *H. gambelii.*

As 13 out of 15 of Baird's positively identified specimens of his *H. gambelii* came from points near the coast of California, only 30 to 40 miles north of San Francisco, it seems proper to assume that a large series of specimens in the Museum collection from Nicasio, Marin Co., Cal., collected by Mr. C. A. Allen, typically represent Baird's *Hesperomys gambelii*, they agreeing also with his description of the species. Other specimens from Lake, San Benito and Santa Clara Counties, received for examination from the Leland Stanford Junior University collection, are also similar. This gives a series of about 40 specimens from the typical region, representing adults and young, and various seasons of the year. From this material I propose to redescribe the subspecies, as follows:

Sitomys americanus gambelii.—Adult: Above mixed dark brown and yellowish brown, bordering on bay, generally rather darker along the middle line of the back (but not forming a dorsal band as in the eastern forms of *americanus*) and grayer on the nape and crown; sides less mixed with blackish and hence more yellowish, but without forming a fulvous lateral line; beneath clear grayish white. Ears moderate, dusky, rather thinly haired, and with a narrow silvery border; tail strongly bicolor, dusky or blackish above and grayish white below, about equal in length to head and body. Fully adult specimens average (15 specimens, from collector's measurements): total length, 164 mm.; tail vertebræ, 80; ear, 12.5.[2]

Young: At first very dark slaty plumbeous above, later becoming blackish, at one stage the whole central portion of the dorsal area being nearly black; later still the yellowish brown comes in, young adults being dusky yellowish brown, through the abundance of intermixed blackish hairs. In old specimens there is only a slight mixture of black, the prevailing tint being yellowish brown, with occasionally a slight reddish cast, resulting in a pale bay tint.

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[1] It might be thought necessary to take as the type the first specimen enumerated by Baird in his table of specimens under *H. gambelii*, which is No 663, from "Natchess Pass, Cascade Mountains, W. T." It must be remembered, however, that it was the custom of Prof. Baird, as it is of most writers, to tabulate his specimens in some geographical sequence, beginning usually with the most northern locality represented; and in a case like the present one of the most aberrant examples might thus be the first on the list. In the present case, however, a Monterey specimen is particularly mentioned in the description, while No. 663 is not. It may be further added that No 663, as Mr True informs me, cannot now be found.

[2] Dr Coues (Mon. N. Am. Roden., p. 70) gives measurements of the nine alcoholic specimens from Petaluma and Tomales Bay which average as follows: Head and body, 70 mm.; tail vertebræ, 67; total length, 137 mm.; the series probably including some specimens not fully adult.

Sitomys americanus austerus (*Baird*).

Hesperomys austerus Baird, Proc. Acad. Nat. Sci. Phila. 1855, p. 336 (Fort Steilacoom and Spokan Plains); Mam. N. Amer. 1857, p. 466.

Hesperomys austerus Baird was based on specimens "collected at Fort Steilacoom, Puget Sound, by Dr. Geo. Suckley, U. S. A., and by Dr. Cooper on the Spokan Plains" (Baird, orig. descrip.). As Fort Steilacoom is first mentioned, it is proper to take this locality as the type locality of the species, whence came also all of the specimens except one mentioned by Baird in his second and more detailed account of the species. Of the seven skins enumerated by Baird in 1857, only one, Mr. True informs me (in a letter of date June 18, 1893), is at present in the National Museum collection. This (No. 1964, U. S. Nat. Mus., "Fort Steilacoom, W. T., March 15, Dr. Geo. Suckley, U. S. A.") is now before me and is marked as the type of the species. This is an adult, and is therefore probably not the real type, as the original description was obviously based on an immature example, as shown both by the measurements and the coloration given in the original diagnosis.

There is little to add to Baird's later (1857) account of the species. It is apparently a little larger than *gambelii*, with a relatively much longer tail. In coloration *austerus* differs from *gambelii* (judging from a series of specimens from the coast of British Columbia, about 125 miles north of Fort Steilacoom) in being much darker and browner, the general color above varying from yellowish brown (nearly as in average specimens of *gambelii*) to deep bay or dark chestnut finely mixed with black, averaging many shades darker than in *gambelii*.

Sitomys boylii (*Baird*).

Hesperomys boylii Baird, Proc. Acad. Nat. Sci. Phila. 1855, p. 355 (El Dorado Co., Cal.); Mam. N. Am. 1857, p. 471.

Hesperomys boylii Baird was based on a single specimen (afterwards mounted) "collected on the middle fork of the American River [in El Dorado Co.], California, by Dr. C. C. Boyle" (Baird, orig. descrip.). In his later (1857) account of the species he referred to it a specimen (No. $\frac{578}{1701}$) from "Shoalwater Bay, W. T.," and another (No. 810) from "Astoria, O. T." Fortunately these last two specimens are extant, and, through the kindness of Mr. True, are both before me. After due consideration I have no hesitation in referring them both to Baird's *H. austerus*. The real type, No. $\frac{356}{1270}$, from El Dorado County, California, is also still extant and is before me. It is, however, in very bad condition, being evidently much faded from long exposure to light as a mounted specimen, and having also lost both its ears and being otherwise dilapidated. It is therefore nearly worthless, so far as throwing much light on the character of *H. boylii* is concerned.

The account of the coloration is too vague to be of much importance in such a group as the present. The measurements as given in the two descriptions are discrepant at several points, aside from an obvious important typographical error in each. In the first account the length of head and body is given as 3 and 4-twelfths inches (=85 mm.) and the tail to end of vertebræ as 3 and 9½-twelfths inches (=95.3 mm.), giving a total length of about 180.3 mm., which is considerably above the average for any member of the *S. americanus* group, with the tail vertebræ alone rather longer than head and body. In the second account the length of "nose to tail" is given as 5.25, which is probably a misprint for 3.25 (=82.5 mm.), and "tail to end of vertebræ" as 3.80[1] (=96.5 mm.), giving a total length of 179 mm., or practically the same as before. We thus have a rather large mouse, with the proportions of *austerus* and the coloration of *gambelii* (compare on this head Baird's descriptions of his *H. boylii* and *H. gambelii* in Mam. N. Am., pp. 465 and 471).

The skull, however, is much larger than that of any of the ordinary forms of the *americanus* group, quite equaling that of *S. martirensis* and other forms of the *truei* group. The facial portion of the skull is broad, and the cranium rather narrow and well rounded.

I have before me two specimens from Mt. Tallac, El Dorado

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[1] This measurement is substantiated by the caudal vertebræ, still extant, preserved separately with the skull

Co., Cal. (Coll. Stanford University), but one is quite young and the other apparently not fully adult; they do not appear to differ appreciably from examples of *gambelii* of corresponding ages from the adjoining coast district. They are rather small, short-tailed mice, and this seems to forbid their reference to "*boylii*."

Under all the circumstances of the case it seems best to leave *Hesperomys boylii* in abeyance until specimens answering to its peculiar characters have been obtained from the type locality. It may prove to be a southern mountain form of *austerus*, or, more probably, a very distinct type.

In further reference to Baird's West Coast species of *Hesperomys*, it may be added that Dr. Coues, in 1877 (Mon. N. Am. Roden., pp. 70, 71), gave a table of "Measurements of about fifty (and a list of [about fifty] other specimens purporting to be *Hesperomys* '*gambeli*' from Washington and Oregon Territories and California." The table proves on examination to be a heterogeneous mixture of skins and alcoholics, all treated as of equal value for comparison, from localities almost as unlike in physiographic conditions as the continent affords, varying from the cool, rainy Puget Sound region to the arid, semitropical districts of Fort Mojave and San Diego in Southern California. Speaking generally, those given on p. 70 (l. c.) agree well in size and proportions with *gambelii* and those on p. 71 with *austerus*. Thus 9 alcoholics from Petaluma and Tomales Bay average in total length, 137 mm.; head and body, 70; and the tail vertebræ alone, 67; while the same measurements of 13 alcoholics from Puget Sound average respectively 164, 80, and 85—showing a marked difference in size and proportions. Ruling out all of the 'dry' specimens as wholly unreliable, we will merely note that Coues says (l. c., p. 72): "Simiahmoo specimens [skins]. . . . are so much darker than 'gambeli' from the dry, open parts of California, that they stand rather nearer 'austerus' in color than the former examples of the species they are supposed to belong to!" Given, such an illogical basis as this, and the results reached in Dr. Coues's generalizations on the three forms *gambelii*, *austerus* and *boylii* are not surprising.

In this connection a word on the value of measurements for purposes of comparison. It is now of course recognized that measurements from skins may be widely misleading and are wholly unreliable when nice points are at stake; and especially is this true of skins of small mammals made prior to the last few years. This is due partly to different methods of preparation, or to lack of care on the part of the collector, and partly to unequal skrinking of different parts in drying. For illustration, I will take two series of measurements made by the same person of specimens taken at the same locality, the one from skins and the other from alcoholics, namely, Dr. Coues's measurements of 20 skins and 20 alcoholics of the common white-footed mouse of Massachusetts, all collected by Prof. J. P. W. Jenks at Middleboro', Mass., in 1855. I will simply premise that the skins were prepared with unusual care and skill for that early time, and were far better than the average of such material extant for the next thirty years:

	Head and body.		Tail vertebræ.		Total length.		Ratio of tail to total length.
	Mm.	Inches.	Mm.	Inches.	Mm.	Inches.	
Skins........	91	3.59	75	2.95	166	6.54	45
Alcoholics....	84	3.31	78	3.08	162	6.39	48

It thus appears that what one might *á priori* suppose to occur is easily demonstrable—namely, that in skins the body is apt to be unduly lengthened and the tail somewhat shortened as compared with the true length.

The subjoined table gives a *résumé* of a very extensive and instructive table of measurements of a large number of *Sitomys americanus*, taken from specimens in the flesh, recently published by Mr. Gerrit S. Miller, Jr. (Proc. Biol. Soc. Washington, VIII, 1893, pp. 64-66), to which I have added, for comparison, those just cited from Dr. Coues. Mr. Miller's measurements are here arranged according to size, beginning with the smallest, which arrangement, it will be noted, brings about a curious juxtaposition of localities. The considerable variation in the four series from neighboring Massachusetts localities is also noteworthy.

MEASUREMENTS OF *Sitomys americanus* (KERR).

LOCALITY.	No. of Species.	Total Length.	Tail Vertebræ.	Ratio.	Measured by.
Haddonfield, N. J....	13	158	70	44.3	S. N. Rhoads.
Digby, N. S.........	12	163	77	47.1	Outram Bangs.
Elizabethtown, N. Y..	20	167	73	43.6	G. S. Miller, Jr.
Liberty Hill, Conn....	17	168	72	42.8	Outram Bangs.
North Truro, Mass ...	14	169	74	43.8	G. S. Miller, Jr.
West Dedham, Mass. .	20	171	75	43.9	"
Peterboro', N. Y......	14	171	76	44.4	"
Seekonk, Mass	15	184	79	42.9	"
Middleboro', Mass....	20[1]	162	78	48.0	Elliott Coues.
" "	20[2]	166	75	45.0	"

But even under the most approved modern methods the element of personal equation may be an important matter for consideration, even when similar methods are supposed to be pursued in the preparation of skins, or in taking measurements before skinning. The same tension may not be employed in laying out the dead animal for measuring, or the same point chosen for the base of the tail. One person will thus get somewhat larger measurements than another, or a slightly different ratio of tail vertebræ to head and body. This is illustrated in the present collection, where two well-trained collectors working in company at the same localities, and measuring their specimens in the same manner, so far as can be judged by the labels, reach different average results in several cases where large series of specimens are taken of the same species. Thus, in the case of *Sitomys americanus thurberi*, described above, the measurements of a series of 43 adult specimens taken by one of the collectors averages for the total length 160 mm., and for the tail vertebræ 75 mm.; while in a series of 22 specimens taken by the other collector the corresponding measurements are respectively 170.4 mm. and 79 mm. Yet the dates and localities, and the general character of the specimens as to age and sex, are the same for each series. The same occurs also in the case of the large series of *Tamias obscurus* (see below, p. 198), where in one series the average length of head and body is 131 mm. and of tail vertebræ 87 mm., while the same measurements for the other series are respectively 134 mm. and 99 mm. The variation in each case is parallel, in both instances one of the collectors getting larger measurements than the other.

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[1] Alcoholic. [2] Skins.

As a further instance I may mention two large series of *Sitomys californicus* from southern California, taken by different collectors, both of the highest standing as regards the quality of their specimens, at localities not over thirty miles apart, and both similar as regards physiographic conditions, where the difference in the average measurements is even greater than in the two cases already cited. And possibly some of the differences shown in the above *résumé* of Mr. Miller's tables may be due more to the 'personal equation' element than to actual differences.

As is well known to those who have measured many specimens, of either birds or mammals, it is very difficult to repeatedly remeasure the same set of specimens and get always exactly the same results. The discrepancies, however, will ordinarily be small, and will rarely affect the average of a series. Hence measurements by the same person may be taken as strictly comparable; on the other hand, measurements by different persons are liable to vary, especially in the case of small mammals, though in each case measured with equal care, through slight, and probably unconscious, differences in methods, so that two persons measuring the same series of specimens independently of each other are pretty sure to obtain appreciable average differences in results. In other words, there is in our work the rather important element of *personal equation* to be on our guard against in dealing with series from different localities, when collected and measured by different collectors.

10. Spermophilus grammurus beecheyi (*Rich.*).—Two specimens, ♂ adult, altitude 7500 feet, May 11; ♀ ad., altitude 8200 feet, May 14. These specimens agree closely with examples from Alhambra, San Diego Co., Cal.

Mr. Thurber says: "Spermophiles were not common; saw perhaps twenty on the San Pedro Martir Mountains."

11. **Tamias leucurus peninsulæ,** subsp. nov.

General coloration much darker than in very dark specimens of *T. harrisi*. Top of head dark reddish brown strongly varied with black; nape and anterior part of back gray, passing into dusky brownish over the pelvic region, like the crown; outside of fore legs and thighs reddish cinnamon, much brighter than the same parts in *T. leucurus.* Lower parts and a single stripe on each side, extending from the shoulder to the rump, white. Tail very short, iron gray above, white below, bordered subterminally with black.

Measurements.—Total length, 213 mm.; tail vertebræ, 50; hind foot, 35.5.

Type, $\frac{6814}{4948}$, ♂ ad., San Telmo, L. Cal., April 30, 1893, coll. A. W. Anthony.

Unfortunately this Ground Squirrel is represented by only a single specimen, an adult male. It differs from all of its allies in its relatively very short tail and very dark coloration.

Respecting this species Mr. Anthony, in reply to a letter of mine to him, writes me as follows: "I tried hard to get more of those *Tamias*, as I have always regarded them as different from *leucurus*, but we passed very hurriedly through their habitat, which, so far as I know, reaches from a point about forty miles south of the boundary line to a little below San Quintin, and not over thirty miles back from the coast, to about 2500 feet above the sea. I saw only three or four on this trip. They are common in places near San Quintin."

12. Tamias obscurus *Allen.*

Tamias obscurus ALLEN (ex TOWNSEND MS.), Bull. Am. Mus. Nat. Hist. III, p. 70, June, 1890.

This species, originally described from the San Pedro Martir Mountains, is represented by a series of 49 specimens, taken May 6 to 28, at altitudes varying from 7000 to 8500 feet. They include a number of half-grown young, but are mainly adults in very worn, ragged coat. A number are in molt, while a few have nearly fully acquired the post-breeding dress. So far as the majority of the specimens are concerned there is little to add to the original description, based on eight May specimens, taken by Mr. C. H. Townsend. The young specimens bear an unexpectedly close resemblance in coloration to the young of corresponding age of *Tamias merriami*, and among the adults there are also cases of close resemblance between the two forms. In fact, the present material seems to show that *T. obscurus* is a southern representative of *T. merriami* rather than a close ally of *T. dorsalis*, as originally supposed. The three forms evidently form a group more closely related *inter se* than is either with any other form of the genus.

As already said, there is little to add to the original description of the *breeding pelage*, or to the comparisons based thereon, but the post-breeding pelage is so different as to require further description.

Post-breeding Pelage.—Dorsal streaks much more sharply defined than in the faded breeding pelage. Four light streaks, clear grayish white, separated by three dark streaks, with an additional outer dark streak outside of the outer light one. Central dark streak chestnut, mixed more or less from a point behind the shoulders posteriorly with black, in some specimens black prevailing ; inner pair of dark streaks paler, yellowish chestnut, with little or no black ; outer pair still paler and more yellowish. Post-auricular patches large, white or grayish white, instead of indistinct and dull grayish as in the faded breeding pelage. Flanks dull yellowish brown, varying in some specimens to quite strong reddish brown ; sides of shoulders rather clear gray, sparsely mixed with black-tipped hairs. Below clear pure white instead of dull grayish white.

There is a wide range of individual variation, as there is also in *T. merriami*, and specimens of the two forms often agree closely in coloration. *T. obscurus*, however, is somewhat smaller, with a relatively much shorter tail. A large series of adults average 130 mm. in length of head and body and 87 in length of tail vertebræ, as against 135 and 115 respectively for the same parts in *T. merriami*, and 134 and 104 in specimens of *T. dorsalis* from northern Arizona.

This species, according to Mr. Thurber's notes, "was probably more abundant than any other. It is almost exclusively a rock dwelling species, every large mass of granite boulders, of which the country is full, having a family. I never saw them in trees, but sometimes they would get up in the bushes three or four feet from the ground to scold."

13. **Sciurus hudsonius californicus** *Allen.*—One specimen, ♀ ad., San Pedro Martir, altitude 8200 feet, May 18. This specimen is in very worn pelage, but as nearly as can be judged is referable as above.

14. Scapanus anthonyi, sp. nov.

A miniature of *Scapanus townsendii* with the pelage much darker (nearly black) and more lustrous. Length, 135 mm.; tail, 26.

Cranial characters.—Similar in general to those of *S. townsendii*, except that the interorbital and rostral portions of the skull are relatively broader. The fourth premolar on one side, however, is wanting and on the other is rudimentary; but this may be abnormal. Extreme length, 30 mm.; basilar length, 28.5; least interorbital breadth, 7.6; greatest mastoid breadth, 15.3; lower jaw, incisive border to condyle, 22.4.

Type, No. $\frac{6818}{4947}$, ♂ ad., San Pedro Martir Mountains (alt. 7000 ft.), May 8, 1893; coll. A. W. Anthony.

This species is based on a single male specimen, and although so small, the worn condition of the teeth show it to be an old individual.

In general bulk *S. anthonyi* is less than half the size of *S. townsendii* from Nicasio, California, adults of which average 185 mm. in total length, with the tail 38, while the skull measures 37 in total length, with a mastoid breadth of 17, and lower jaw (incisive border to condyle), 24.7.

Mr. Thurber says "moles were rare," and that this specimen was caught while burrowing.

There has been for some time a similar specimen in the Museum collection (No. $\frac{1567}{755}$, ♂ ad.) from San Bernardino, California, collected by Mr. F. Stephens, April 16, 1887. This specimen is partly in molt, the patches of new coat being dark and the old coat much lighter, as though faded. It is slightly larger than the San Pedro Martir example, measuring: total length, 150, tail vertebræ, 28 (from collector's measurements before skinning).

Scalops texanus *Allen.*

Scalops argentatus texanus ALLEN, Bull. Am. Mus. Nat. Hist. III, p. 221, April, 1891.

This Mole was originally described (l. c.) as a subspecies of *Scalops argentatus*, from a single specimen, labeled as from Presidio County, Texas. Recently the Museum has received a series of six specimens of a Mole evidently of the same species, from Rockport, Aransas Co., Texas, collected by Mr. H. P. Attwater.

These later specimens agree essentially with the type. The great difference in coloration and in size between this species and *S. argentatus* seem to indicate that the original reference of this form to *argentatus* as a subspecies was an error. This series of seven specimens agree in not only their small size but in the peculiar bronzy tint of the fur as compared with the silvery tint in *argentatus*. In *texanus* also there is a well-marked spot of orange on each side of the forehead and more or less orange-tinted fur at the base of the fore paws.

15. **Nyctinomus brasiliensis** *Is. Geoffr.*—A series of ten specimens is referred provisionally to this species. While of the *N. brasiliensis* type, they are much larger and lighter colored than examples from Florida and Cuba—the only alcoholic specimens available for comparison.

The following localities are represented: Carriso Creek, April 4, one specimen; San Telmo, April 10 and 29, four specimens; Valladares, May 3, two specimens; San Pedro Martir Mountains (altitude 8200 feet), one specimen. Eight are males and two are females. Of the males six have the gular sac and two are without it, while of the two females it is present in one and not in the other.

16. **Vesperus fuscus** (*Beauv.*).—Gato Creek, 3 specimens, and San Pedro Martir, 10 specimens, taken at altitudes ranging from 7000 to 8500 feet. They vary greatly in color, the Gato Creek specimens being much paler than those from the San Pedro Martir Mountains.

17. **Vesperugo hesperus** (*H. Allen*).—This species is represented by three specimens, taken as follows: Gato Creek, June 5, one specimen; Guadaloupe Valley, April 27, two specimens.

18. **Atalapha cinerea** (*Beauv.*).—The 10 specimens representing this species were taken as follows: Carriso Creek, April 18, two specimens; Salado Valley, one specimen; San Pedro Martir, seven specimens, at altitudes varying from 7000 to 8200 feet.

19. Vespertilio evotis *H. Allen.*—Four specimens, San Pedro Martir Mountains, altitude 7000-8200 feet, April 17, 27, and 28.

20. Vespertilio nitidus *H. Allen.*—A series of 21 specimens of a small bat are provisionally referred to this species. They were taken May 15 to 28, in the San Pedro Martir Mountains at altitudes varying from 7000 to 8500 feet.

ADDENDUM.—Since the foregoing was put in type I have received, through the kindness of Mr. Walter E. Bryant, Curator of Mammals and Birds at the California Academy of Sciences, about 50 specimens of *Sitomys* from the collection of the Academy, which prove of exceptional interest. The greater part are from the southern part of the peninsula of Lower California. The remainder include a small series of *Sitomys americanus gambelii*, three specimens of *S. californicus*, and one of *S. gilberti*, mainly from the coast region of central California. Of the three specimens of *S. californicus*, two are from Monterey, the type locality of the species, and the other from Glenwood. The latter has the tail conspicuously tipped with white—the only one of the three thus marked. The specimen of *S. gilberti* is from Mount Hamilton, the type locality.

The Lower California specimens are about equally divided between two species, one of which, from the Sierra da la Laguna, I am unable to distinguish from my *S. martirensis*, described above (p. 187) from the San Pedro Martir Mountains. The other, from Comondu and San José de Cabo, is new to me, and is allied in general characters to *S. eremicus*. It is a fulvous mouse with a long naked tail and rather large ears.

Article XIII.—ON A COLLECTION OF MAMMALS FROM THE ISLAND OF TRINIDAD, WITH DESCRIPTIONS OF NEW SPECIES.

By J. A. Allen and Frank M. Chapman.

This paper is based on a collection of about 200 specimens made by the junior author during the months of March and April, 1893. With few exceptions the species herein recorded were secured in the south central part of the island, at a point twelve miles north of the southern coast and seven miles southeast of Princestown. Here, at the border of the forest which reaches to the coast, is situated a Government rest-house. Collecting was confined to within a radius of a mile of this rest-house. Points where small streams entered the forest proved the best collecting grounds. Here in close proximity were water, the dense low growth of bordering balisiers (*Heliconia*), and the forest itself. All the species secured near the rest-house doubtless might be taken in a short time within a radius of one hundred feet in a locality of this nature. The indigenous species secured here are doubtless all forest inhabiting.

The collection of small Rodents is of special interest as containing the results of perhaps one of the first attempts at systematic trapping of small mammals with the most approved traps. The collector, however, was handicapped by entire ignorance of the habits or even of the kinds of mammals which might be found, and also by the fact that birds were the first object of his efforts. Furthermore, at least one-third of the animals trapped were destroyed by predatory mammals or ants.

We believe, therefore, that, prolific as the field has proven, further collecting in the same region would add many species among the smaller Rodents.

A future paper in this Bulletin will give a report on the birds collected, and more fully describe the localities visited and the faunal affinities of the island.

Very little has been hitherto written especially upon the mammals of Trinidad, and very few specimens known to have been collected on the island appear to be extant in museums. Ledru[1] gave a list of ten species as early as 1810. De Verteuil, in his 'Trinidad,'[2] devotes a number of pages to the mammals (pp. 85–89 and 361–365), and gives also a vague nominal list of the species (pp. 360, 361). The list, however, is so indefinite that it is impossible to determine the number of species it is intended to include, while the nomenclature adopted is too erroneous to merit serious consideration. His remarks on the habits and distribution of many of the larger species are of interest.

The first serious attempt to give a scientific catalogue of the mammalian fauna of the island is Mr. Oldfield Thomas's 'A Preliminary List of the Mammals of Trinidad,'[3] published early in the present year. "The present list," says Mr. Thomas, "is only written to form a basis on which a complete scientific list of the mammals inhabiting Trinidad may be founded, and to show members of the Society how extraordinary little is definitely known of the mammals of the Island." He accordingly urges upon the attention of the members of the Trinidad Field Naturalists' Club the importance of collecting specimens for transmission to the British Museum for scientific determination. Mr. Thomas's list includes 52 species, of which 27, or more than one-half, are Bats, and 8 only are Rodents, one of these being mentioned only generically. Mr. Thomas believes that this large number of Bats represents less than half of the species actually occurring on the island, and calls special attention to the Rodentia as likely to afford species "which are as yet absolutely unknown." Mr. Thomas's foresight in respect to these groups is well vindicated by the present collection, which adds one species to the list of Bats, and raises the number of known Trinidad Rodents from 7 to 19. The number of known indigenous Muridæ is raised from one to eight, six of which it has been considered advisable to describe as new. It is not probable that any of them are strictly confined to the island, but doubtless occur on adjoining portions of the mainland. Some of them are obviously related more or less closely to species described from western and southern Brazil, though it is hardly probable that any of them will prove strictly identical. While a large number of species of Muridæ have been recorded from Ecuador, Peru, Chili, southern Brazil and the more southern parts of the continent, the literature of the subject contains very few references to specimens from northeastern South America, so that Mr. Thomas's pertinent remarks on our ignorance of the Muridæ inhabiting Trinidad will apply with equal force to a large area of the adjoining portions of the mainland.

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[1] Voyage aux Iles de Ténériffe, la Trinité, etc., I, 1810, p. 256.

[2] Trinidad: Its Geography, Natural Resources, Administration, Present Condition, and Prospects. By L. A. A. de Verteuil, M. D. P., etc. One vol., 8vo., 1858. We are able to cite only the second edition, published in 1884, which, so far as the natural history matter is concerned, appears to be textually the same as the first.

[3] Journ. Trinidad Field Naturalists' Club, I, No. 7, April, 1893, pp. 158–168.

1. **Mycetes,** sp.—A Howling Monkey was not uncommon in the forests about two miles from the rest-house. At this distance their howling or, better, roaring chorus, in the early morning could frequently be heard. No specimens were secured, but it is probable, as Mr. Thomas remarks, that the species is *M. seniculus.*

2. **Saccopteryx bilineata** (*Temm.*).—Two specimens, male and female adult.

3. **Saccopteryx leptura** (*Schreber*).—Five specimens, two males and three females.

In both of these species the females are larger than the males, as shown by the following measurements:

S. bilineata,	♂,	forearm,	46;	third metacarp.,	45;	tarsus,	21.6.
"	♀,	"	51.8;	"	49.5;	"	23.9.
S. leptura,	♂,	"	36.8;	"	36;	"	15.7.
"	♂,	"	36;	"	35.6;	"	15.3.
"	♀,	"	39.6;	"	38.1;	"	17.8.
"	♀,	"	41.9;	"	39.6;	"	17.3.

All of the specimens show the two faint whitish dorsal stripes, but in addition to its smaller size *S. leptura* is paler colored throughout, including all of the membranes, and the wing membrane is attached at the ankle joint instead of slightly above it, as in *S. bilineata.*

In the gloomy depths of the forest *S. leptura* was frequently seen coursing for insects during the day.

4. Noctilio leporinus (*Linn.*).—Two specimens, male and female adult. Both have a distinct fulvous line down the middle of the back.

The cave on Monos Island in the first Boca from which so many of these remarkable bats have been secured, seems now to be deserted by them. The specimens above mentioned were taken from a large cave-like fissure in the Huevos Boca to which the collector was piloted by Mr. Morrison. Their stomachs contained the partially digested remains of fish; confirmation, if confirmation be needed, of the now well-known fish-eating habits of this species. At a recent meeting of the Trinidad Field Naturalists' Club (*cf.* Journal, Vol. I, p. 204), the president of the Club, H. Caracciolo, Esq., described the manner in which these bats captured their prey, "by throwing it up with their interfemoral membrane. Simultaneously they bend their heads towards their tails to seize the fish as it is thrown from the water." In support of this observation Dr. A. Woodlock said (l. c.), "that early one morning, at Monos, he distinctly saw the bats in this act." Is it not possible that the much lengthened, curved, acute toe-nails of this species are of assistance to it in catching or hooking fish?

5. Molossus rufus *Geoffr.*—The 25 specimens representing this species show a wide variation in coloration. The specimens representing the extreme color phases were preserved as skins, the others in alcohol. The general coloration varies from deep rich chestnut to blackish seal brown. The ventral surface is a little lighter than the dorsal. Measurements of six adult females and four adult males indicate only a slight sexual difference in size, as follows: Six females, forearm 49.8 (48.3–50.8) mm.; third metacarpal, 49.8 (48.3–50.8); tibia, 18.6 (18.3–18.8); free portion of tail, 25.6 (21.6–27.7). Four males, forearm, 51 (50.8 51.3); third metacarpal, 50.3 (49.3–50.8); tibia, 20.3 (19.8–20.6); free portion of tail, 27.9 (26.9–28.3).

This was by far the most common species of bat observed, and was the only one regularly seen at evening coursing for insects about the rest-house clearing. A colony of about thirty bats of this species, with evidently a few of *M. obscurus*, occupied the attic of a neighboring house. Their retreat was invaded and nineteen specimens secured. A short stick was the only weapon necessary to effect a capture, for while their abode was large and light, and access to the outer air was easy, not one took wing but all endeavored to escape by running. Some ran up the rafters to hide beneath the peak of the house; others ran across the floor, going so rapidly that it was difficult to strike them. When at rest they seemed to prefer sticking to a vertical surface rather than hanging after the usual manner of bats. Of the nineteen specimens taken seventeen were females and two males. Sixteen of the females contained a single fœtus each.

6. **Molossus obscurus** *Geoffr.*—This species is reprsented by a single specimen preserved in spirits. It is an adult female, and contained a single half-grown fœtus. The specimen measures as follows: forearm, 38 mm.; third metacarpal, 38; tibia, 13.2; free portion of tail, 17.8.

A comparison of the measurements of this fully adult female with those given above of *M. rufus* would seem to indicate that these two forms are specifically distinct.

This specimen was found with the colony of *M. rufus* first mentioned. There were evidently other individuals in the same colony, but their smaller size enabled them to secrete themselves in holes from which it was not possible to dislodge them.

7. Chœronycteris intermedia, sp. nov.

Similar in size and general proportions to *Chœronycteris minor*, but with the calcaneum one-half shorter, tibia longer, thumb shorter. Also different in coloration.

Above snuff-brown, the fur slightly paler basally, not "light grayish brown," as in *C. mexicana* and *C. minor*. Below slightly paler than above, about the color of the basal portion of the hairs above. Ears, feet and membranes blackish, naked, except that the fur extends on both surfaces of the wing membranes as far as the elbows, and also along the basal third of the forearm bones on both surfaces. Calcaneum conspicuously shorter, instead of "conspicuously longer," than the foot. Thumb shorter, tibia longer, than in *C. minor*.

Type, No. $\frac{6028}{4741}$, ♀ ad., Princestown, Trinidad, March 28, 1893, coll. of Frank M. Chapman.

The present species is based on three specimens, a skin and skull, and two examples in alcohol.

The genus *Chœronycteris* is now for the first time recorded from Trinidad. The present species, while agreeing with *C. minor* from Surinam in size, appears to differ from it decidedly in coloration, particularly of the underfur, and in the shortness of the thumb, in the greater length of the tibia, and in the calcaneum being much shorter, instead of much longer than the hind foot.

While agreeing in the relative length of the calcaneum with *C. mexicana*, it is widely dissimilar in size, as well as in other features, it being very much smaller in all parts, as shown by the following comparative measurements:

	Sex.	Forearm.		Third Metacarp.		Tibia.		Foot.		Calc'um.		Thumb.	
		mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.
$\frac{6072}{4781}$ *C. intermedia*[1] . .	♀	34.5	1.36	34.5	1.36	12.2	.48	8.6	.34	6.6	.26	5.6	.22
6105 " " [2] . .	♂	33.5	1.32	33.5	1.32	12.7	.50	8.1	.32	6.1	.24	5.1	.20
6104 " " [2] . .	♂	....	....	35.5	1.40	13.5	.53	9.1	.36	6.1	.24	5.8	.23
C. minor[3]		34.3	1.35	34.3	1.35	11.4	.45	8.1	.32	11.2	.44	7.1	.28
C. mexicana[3]		43.2	1.70	40.6	1.60	15.7	.62	10.6	.42	6.6	.26	8.9	.35

In dental and cranial characters *C. intermedia* appears to agree with *C. mexicana* and *C. minor*. The position of the lower premolars as shown in Dobson's plate (Cat. Chirop., Pl. xxvii, Fig. 6, 6*a*) does not agree, however, with his description given in the text (l. c., p. 510).

8. **Artibeus**, sp. nov. ?—A large *Artibeus*, not referable to either *A. planirostris* or *A. perspicillatus*, is represented by a single skin, the skull unfortunately having been stolen by the rest-house cat. It differs in coloration and in the distribution of the fur on the wing-membranes, from any of the currently recognized species of *Artibeus*. The forearm measures 63 mm.; the third metacarpel, 61, and the tibia, 25.4. Color above and below light brown, much lighter on the head and anterior half of the body, the hairs nowhere tipped with gray. A broad white stripe above and a faint whitish line below each eye.

9. **Lutra insularis** *F. Cuv.*—An adult female (No. $\frac{6042}{4765}$, fully mature but not aged) gives the following measurements:

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[1] Measurements from skin

[2] Measurements from alcoholics.

[3] Measurements from Dobson, Cat. Chirop., pp. 510, 511.

Total length, 1060 mm.; head and body, 610; tail vertebræ, 450; hind foot, 103; ear from crown, 20. Skull: basal length,[1] 98; interorbital breadth, 19.5; Pm.4, 9. These cranial measurements somewhat exceed those given by Mr. Thomas (l. c.) for two specimens of *L. felina*. In the absence of proper material for comparison we provisionally adopt the name above given.

The Otter is apparently a rare animal in Trinidad. Hunters were either ignorant of its presence or said that they had met with it on very few occasions.

10. Sciurus æstuans hoffmanni *Peters.*—A series of ten specimens prove to be much nearer subspecies *hoffmanni* from Costa Rica, both in size and coloration, than to the true *æstuans* of Brazil, although clearly intermediate between the two, as respects both size and coloration.

The measurements of this series are as follows: Total length, 371 (348–390) mm.; head and body, 197 (182–208); tail vertebræ, 174 (145–208); hind foot, 47 (43–52); ear, 19. The skulls of six specimens average 50 mm. in total length and 28.7 in greatest zygomatic breadth, as against respectively 53 and 31 in three skulls of *hoffmanni* from Costa Rica. The coloration is much nearer that of *hoffmanni* than it is to Santarem and Chapada examples of *æstuans*.

This species is very common. It lives in the forests, particularly in those which are bordered by cacao groves, to the fruit of which they do much damage. Its voice bears an unmistakable resemblance to that of *Sciurus hudsonius*, but its vocabulary is more limited, and it is far less noisy than that species.

Nectomys palmipes, sp. nov.

Similar in general external and cranial features to *N. apicalis* Peters, but much smaller and darker, with a relatively much shorter tail.

Adult.—Pelage soft, full, glossy. General color above pale yellowish brown; the middle of the dorsal region, from the nose to the tail, strongly blackish; the sides grayish buffy brown, sparingly varied with black-tipped hairs; the top of the head, from the muzzle to behind the eyes, blackish varied with gray. Below, whitish with a wash of pale buff, strongest over the middle of the ventral region, the fur grayish plumbeous beneath the surface. The line of demarcation between the coloration of the dorsal and ventral surfaces very indistinct. Ears oval, evenly rounded above, flesh colored at base, dusky apically, sparsely haired. Limbs externally grayish brown, the feet scaly, so thinly haired as to be nearly naked. Palms and soles scaly, the latter 5-tuberculate. Tail a little shorter than head and body, blackish, nearly unicolor, heavily furred for the basal half-inch or more, the rest scantily clothed with short bristly hairs, which form a very slight pencil at the tip.

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[1] These measurements are in conformity with those given by Mr. Oldfield Thomas, P. Z. S., 1889, p. 200.

Measurements, average of six adults (four males and two females) taken before skinning: Total length, 402 (380–433) mm.; head and body, 206 (189–223); tail, 196 (175–210); hind foot, 46.5 (44–48); ear from crown, 18.6 (16–20). The females are considerably smaller than the males.

Young.—Above uniform mouse-gray, varying to mouse-brown, over the whole dorsal region; sides with a wash of buff, very slight in the quarter-grown specimens, becoming stronger as the animal increases in age; ventral surface clear gray, in older specimens whitish gray.

Skull similar to that of *N. apicalis*,[1] especially in regard to the size and form of the interparietal, in which it differs notably from *N. squamipes*. An adult male skull measures as follows: Total length,[2] 47; basal length, 38; greatest zygomatic breadth, 24; mastoid breadth, 16.3; least interorbital breadth, 3.6; length of nasals, 18.3; length of interparietal, 4.3; width of same, 8.9; distance from incisors to first molar, 11.9; length of crown surface of upper molar series, 6.9; length of lower jaw (point of incisors to posterior border of condyle), 26.9; height at condyle, 13.5.

Type, No. $\frac{5928}{4658}$, ♂ ad., Princestown, Trinidad, April 10, 1893, coll. Frank M. Chapman.

This species is based on a series of 12 specimens, 7 of which are adult and five in various stages of immaturity, the youngest about one-fourth grown.

The adults vary somewhat in coloration, chiefly in the intensity of the yellowish brown above, the amount of black over the middle of the dorsal region, and in the degree of buffy suffusion below, which varies from a slight tinge to a strong wash. The skulls of course vary in size and proportions with age, but in the fully adult there is little variation. The nasals end in an acute V-shaped point, which projects beyond the fronto-maxillary suture. The interparietal is convex posteriorly, nearly straight or slightly convex on its anterior border, with the transverse about twice the antero-posterior extent, or rather less.

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[1] As figured by Peters, Abhandl. Akad. Wissensch. zu Berlin, 1860, p. 148, pl. ii.

[2] In this paper "total length," unless otherwise stated, is the distance from the most projecting part of the skull in front—anterior border of nasals or premaxillaries, as the case may be—to the most projecting part of the skull behind—occipital plane or occipital condyles, as the case may be; "basal length" is the distance from the inner base of the incisors to the posterior border of occipital condyles. The length of the lower jaw is taken from the tip of the incisors to the posterior edge of the condyle, unless stated otherwise. In all instances measurements are taken with callipers in a straight line between the extreme points mentioned.

In cranial characters this species is much more nearly related to *N. apicalis* Peters, from Guayaquil, than to *N. squamipes* (Brants); the very largest skulls about equal the dimensions given by Dr. Peters for that of *N. apicalis*. It also resembles *N. apicalis* in its 5-tuberculate soles, but differs from it in its darker coloration, smaller size, and relatively much shorter tail, which is considerably shorter than the head and body, instead of considerably longer as in *N. apicalis*. The tip of the tail is not white, as was the case in the type of *N. apicalis*.

N. palmipes differs from *N. squamipes* in having the soles 5-tuberculate instead of 6-tuberculate, and in the very different form of the interparietal, which in *N. squamipes* is very much narrower antero-posteriorly, and transversely much more extended.

Mr. Thomas gives "*Holochilus squamipes* Bts." from Trinidad (presumably = *Nectomys squamipes* Peters), but that species is unrepresented in the present collection.

All the specimens secured were taken in the low, dense growth near a small stream.

12. Tylomys couesi,[1] sp. nov.

Of the size and general coloration of *T. nudicaudatus*, but with the tail uniform dusky, somewhat hairy and slightly tufted, instead of particolored and naked as in *T. nudicaudatus* and *T. panamensis*.

Above nearly uniform cinnamon brown, everywhere punctated with black, through the presence of longer black-tipped hairs overtopping the general pelage. Below white, with a slight tinge of yellow, the white extending to the base of the fur. Line of demarcation between the color of the dorsal and and ventral surfaces well defined. Edges of the feet and toes soiled whitish. Whiskers very long, black, the longest measuring 70 mm. Ears large, naked, dusky. Tail rather longer than head and body, black from base to tip, nearly naked basally, but scantily clothed with short blackish hairs, increasing in length and abundance toward the tip, where they conceal the annulations, and form a well-defined pencil at the tip. Hind feet short and broad, with naked soles.

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[1] Named for Dr. Elliott Coues, in recognition of his important contributions to North American mammalogy.

Measurements (from the fresh specimen): Total length, 460 mm.; head and body, 208; tail to end of vertebræ, 252; pencil at tip, 11; hind foot, 35; ear from crown, 24.

Type and only specimen, No. $\frac{5956}{4685}$, ♂ ad., Princestown, Trinidad, April 6, 1893, coll. Frank M. Chapman.

This specimen is in apparently rather worn pelage. The coat is very short but thick and soft, and the underfur very woolly, particularly on the ventral surface. Probably in fresh pelage the color would be brighter and more yellowish rufous.

The skull is that of a true *Tylomys*, and presents the following measurements: Total length, 44.5 mm.; basal length, 38; greatest zygomatic breadth, 23.4; greatest mastoid breadth, 14.7; least interorbital breadth, 6.4; length of nasals, 16.5; distance from incisors to first molar, 12.7; length of upper molar series, 6.6; distance from posterior border of palatal floor to end of pteygoid hamuli, 8.9; length of lower jaw (tip of incisors to posterior border of condyle), 27; height of condyle, 12; length of lower molar series, 6.7.

This species has a close general resemblance in coloration to the *T. nudicaudatus* Peters of Guatemala and Costa Rica, but it has a hairy, relatively much longer, and very differently colored tail.

The single specimen was taken in the forest, at the entrance to a hole which penetrated beneath the roots of a tree.

13. **Oryzomys speciosus**, sp. nov.

Pelage short (about 9 mm. long on the back), thick, soft, cottony below. Color above yellowish rufous, darker reddish brown over the middle of the back, where there are intermixed a few longer black-tipped hairs; paler and more yellowish along the sides. Below, pure white to the base of the fur. Ears of medium size, rather narrow, evenly rounded on their posterior upper border, dusky brown, well clothed with very short brownish hairs, which have a slight reddish cast. Fore limbs yellowish like the sides of the body, as far as the base of the toes, the toes lighter, buffy white; palms yellowish flesh-color. Hind limbs yellowish, like the flanks, as far as the base of the toes; toes very scantily haired, yellowish gray; soles dusky, 6-tuberculate. Tail considerably longer than head and body, the basal half inch heavily furred and colored, below as well as above, like the rump, forming a basal, furred, yellowish brown ring; rest of the tail uniform pale brown, annulations very narrow and indistinct, the scales minute, practically naked except near and at the tip, where it is thinly clothed with short dusky hairs, forming a minute, scarcely appreciable pencil. Under a lens the whole tail is found to be haired, but so scantily as not to appreciably obscure the annulations. Whiskers scanty, black.

Measurements, from the fresh specimen: Total length, 261 mm.; head and body, 124; tail vertebræ, 137; hind foot, 24; ear from crown, 14.

Skull, in general features, much like that of *O. palustris*; it is, however, heavier and larger, with a heavier raised supraorbital ridge; the interparietal is also several times larger, relatively as well as absolutely; the anterior palatine foramen is shorter and much broader. Total length, 30.5; basal length, 25; greatest zygomatic breadth, 17.3; greatest mastoid breadth, 12.2; least interorbital breadth, 5.6; length of nasals, 11; length (antero-posterior axis) of interparietal, 5; breadth (transverse axis) of interparietal, 9.4; length of anterior palatine foramen, 5.6; greatest breadth of same, 2.8; distance between incisors and first molar, 7; length of crown surface of upper molar series, 4.5; length of lower jaw (point of incisor teeth to posterior border of condyle), 18.8; height at condyle, 8; length of crown surface of lower molar series, 4.8.

Type and only specimen, No. $\frac{5942}{4573}$, ♀ ad., Princestown, Trinidad, April 26, 1893, coll. Frank M. Chapman.

This species in size, proportions and coloration, strongly suggests *Hesperomys concolor* Wagner, from the Rio Curicuriari, in northeastern Brazil, with which it may prove to be identical.

14. **Oryzomys trinitatis**, sp. nov.

Pelage full, soft and rather long (13 mm. on the middle of the back). Color above bright yellowish rufous, darker, approaching chestnut, and finely varied with black-tipped hairs over the middle of the dorsal region, lighter and more strongly yellowish on the sides; nose blackish and head rather darker than back; below grayish white, the tips of the hairs being soiled whitish and the basal portion gray, showing more or less through the surface. Line of demarcation between the coloration of the dorsal and ventral surface not sharply defined. Ears rather large and quite broad, dusky, and thinly coated with very short blackish hairs. External surface of fore and hind limbs dusky yellowish brown, becoming lighter grayish brown on the toes, which are thinly haired; palms and soles naked, the former brownish flesh color, the latter more dusky and 6-tuberculate. Hind feet rather broad in proportion to their length. Tail very much longer than head and body, furred all around for the basal half inch, the fur yellowish ashy below and colored like the rump above; remainder of the tail pale dusky brown, unicolor, non-penicillate and practically naked throughout, though clothed with very short dusky hairs, generally not readily seen without a lens.

Measurements, from fresh specimens: Total length, 271 mm.; head and body, 123; tail, 148; hind foot, 25; ear above crown, 16.

Skull similar to that of the preceding species, except that the nasals and the facial portion of the skull are much longer and the interparietal much smaller. In old skulls the supraorbital ridge is continued backward to the posterior border of the parietals. Total length, 32.5; basal length, 27.2; greatest zygomatic breadth, 17.8; greatest mastoid breadth, 12; least interorbital breadth, 6.1; length of nasals, 11.4; antero-posterior breadth of interparietal, 3.5; transverse breadth of same, 9.3; length of anterior palatine foramen, 6.4; greatest width of same, 2; distance between incisors and first molar, 8.4; length of crown surface of upper molar series, 4.5; length of lower jaw, 20.3; height at condyle, 8.6.

Type, No. $\frac{5943}{4673}$, ♂ ad., Princestown, Trinidad, April 25, 1893, coll. Frank M. Chapman.

This species is based on three specimens, a very old male and an old female, and a young adult male. The very old specimens are closely similar in all features; the younger specimen, although practically adult as regards size, is less rufous and more yellowish above and rather more whitish below, with the throat pure white to the base of the fur.

This species differs from the preceding in the character of the pelage, in coloration, especially of the lower parts, in being larger and with a relatively longer and less hairy tail, and in various cranial differences, particularly in the much shorter interparietal. What its nearest relative may be among the continental species it is impossible to decide in the absence of proper material for comparison.

15. Oryzomys velutinus, sp. nov.

Pelage thick, short (about 7 mm. long on the back), velvety below. General color above dark cinnamon-brown, darkest and much mixed with blackish on the middle of the back, lighter and more reddish on the sides, brighter reddish on the hinder part of the crown and posteriorly over the shoulders; anterior part of the head dusky grayish brown with only a faint tinge of reddish, and a narrow, indistinct blackish eye-ring; beneath grayish white at the surface, dusky plumbeous basally. Ears large, broadly oval, naked on both surfaces, dusky with a faint reddish cast. External surface of the limbs like the adjoining portions of the body; feet thinly haired above, yellowish gray, this color extending on the hind feet to slightly above the ankles; palms and soles naked, the former flesh-colored, the latter dusky brown, 6-tuberculate. Tail considerably shorter than head and body, naked, very distinctly and clearly annulated in comparison with the two preceding species.

Measurements, from fresh specimens: Total length, 252 mm.; head and body, 135; tail, 118; hind foot, 28; ear from crown, 18.

Young.—Pelage very short, soft and velvety, almost plush-like on the ventral surface. Above blackish plumbeous, paler on the sides, whitish gray below. Later the back becomes nearly black, and the sides acquire a mouse-brown wash.

The skull is of the typical *Oryzomys* style, with, however, the facial portion somewhat lengthened, and the anterior palatine foramen rather short and broad, and the supraorbital ridge, even in old individuals, rather feebly developed. Total length 33 mm.; basal length, 27; greatest zygomatic breadth, 17; greatest mastoid breadth, 12.2; least interorbital breadth, 5; length of nasals, 12.7; antero-posterior breadth of interparietal, 3.8; transverse breadth of same, 10.2; distance between incisors and first molar, 7; length of crown surface of upper molar series, 4.5; length of lower jaw, 20.3; height at coronoid process, 8.6.

Type, No. $\frac{5243}{4163}$, ♂ ad., Princestown, Trinidad, April 16, 1893, coll. Frank M. Chapman.

This species is based on a series of ten specimens, three of which are fully adult, two nearly adult, and five in the blackish plumbeous pelage of the young, varying in age from sucklings to half or two-thirds grown.

The peculiar blackish plumbeous pelage of the young recalls the corresponding 'blue' stage in the genera *Sitomys*, *Neotoma* and *Nectomys*, but which is not found in the typical species of *Oryzomys*, as the genus is represented in the United States. In this species there is a slight deviation toward *Sitomys* in the relatively slightly narrowed and lengthened facial portion of the skull. The auditory bullæ, however, are unusually small, even for an *Oryzomys*, in which genus they are always much smaller than in *Sitomys*.

This species was not found associated with the other species of *Oryzomys*, but was met with in the forests, where it seemed to live beneath the roots of trees or stumps.

16. **Oryzomys brevicauda**, sp. nov.

Adult.—Pelage full, soft, and long (9.5 mm. long on middle of back). General color above yellowish brown, darker and strongly varied with black-tipped hairs over the middle of the dorsal region, lighter, more buffy yellow on the sides; below gray, with a slight buffy wash, the basal portion of the fur dusky plumbeous. Line of demarcation between the coloration of dorsal and ventral surfaces indistinct, often passing gradually the one into the other. Ears of medium size (smaller than in either of the preceding species of this genus), low, broad and very evenly rounded above, dusky, practically naked (pulverulent) on both surfaces (under a lens the surface is shown to be covered with very minute short whitish-tipped hairs). Feet above light grayish brown, with a faint yellowish or buffy tinge, scantily haired; palms and soles naked, the former brownish flesh-color, the latter a little darker brown, 6-tuberculate. Tail about one-fourth shorter than head and body, naked (clothed scantily with hairs so minute as to be nearly invisible without a lens), indistinctly bicolor, pale brown above, lighter, almost isabella color below for the basal two-thirds, the line of demarcation between the two colors indistinct.

Young.—A very young example (probably a nursling) is uniform dusky brown above faintly washed with yellowish gray, more distinct on the head, and particularly on the sides of the head. Below similar but much paler. Inside of ears well clothed with very short yellowish dusky hairs. Nearly full-grown examples are variously intermediate between this and the fully adult phase.

Measurements (average of 10 adult males, taken in the flesh): Total length, 265 (250–280) mm.; head and body, 154 (141–161); tail, 111 (101–120); hind foot, 28 (27–30); ear from crown, 15.3 (13–18). A similar number of females average smaller, as follows: Total length, 235 (220–253); head and body, 142 (132–150); tail, 93 (86–105); hind foot, 26.6 (25–29).

The skull is that of a typical *Oryzomys* (taking *O. palustris* as the type of the genus), except as regards a few minor details, principally the form of the interparietal, which is very narrow antero-posteriorly and very broad transversely, as it is in most of the species of *Oryzomys* here described. An average adult male skull measures as follows: Total length, 32.5 mm.; basal length, 28.7; greatest zygomatic breadth, 17.3; greatest mastoid breadth, 12.5; least interorbital breadth, 5.8; length of nasals, 13.5; antero-posterior breadth of interparietal, 2.5; transverse breadth of same, 10.2; distance from incisors to first molar, 8.9; length of anterior palatine foramen, 6.9; length of crown surface of upper molar series, 4.5; length of lower jaw, 22.9; height of same at condyle, 7.6.

Type, No. $\frac{5981}{4768}$, ♂ ad., Princestown, Trinidad, April 12, 1893, coll. Frank M. Chapman.

This species is represented by a series of 38 specimens, nearly all adults, but including one nursling, and a few others slightly immature. Among the practically adult specimens the general color above varies from strong clear yellowish brown to a darker shade, approaching yellowish chestnut. Below the color varies from pale buffy gray to quite strong buff over the middle of the ventral surface, fading to lighter on the throat and towards the anal region. This variation is, however, mainly due apparently to age, the younger adults being more buffy below and yellower above. The young, as already described, are dusky brown, with a faint wash of pale yellowish brown.

This species is very distinct from either of the preceding, both in external and cranial characters. Its heavy, comparatively coarse pelage gives it almost an Arvicoline appearance, which its relatively smaller ears and shorter tail tend to heighten. In cranial characters it 'most nearly approaches *O. palustris* of any of the species here described, particularly in the form of the lower jaw, which has the coronoid process longer and more decurved, and the posterior border of the mandible more deeply hollowed than is the case in any of the others. It differs from *O. palustris* in the form of the interparietal, through its great transverse breadth as compared with its antero-posterior extent; in this respect essentially agreeing with the preceding species, as it does also in the comparatively slight development of the supraorbital ridges.

This was apparently the most abundant Rodent near the rest-house. With *O. speciosus* and *O. trinitatis* it was found in the dense, low growth which bordered small streams.

17. **Abrothrix caliginosus** (*Tomes*).—A series of 11 specimens of a short-tailed, *Arvicola*-like, rich chestnut-colored mouse is provisionally referred to this species. They agree with a single specimen from Costa Rica provisionally identified with this species,[1] and with Tomes's description of *caliginosus*. As, however, the type locality of *caliginosus* is Ecuador, it seems probable that a comparison of specimens from the two localities will show that the Trinidad animal may be separable.

The coloration above is dark rusty chestnut finely punctated with black, much paler and more yellowish below; ears, tail, and feet black. A series of six adults, measured before skinning, give the following dimensions: Total length, 192 (188–196) mm.; head and body, 123 (121–125); tail, 69 (65–70); hind foot, 24.6 (23–27); ear from crown, 13 (12–15). The dental and external characters agree with Waterhouse's diagnosis of his subgenus *Abrothrix.*

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[1] See this Bulletin, III, 1891, p. 210.

This species, with *Loncheres*, was the only one of the Muridæ or Octodontidæ which seemed to be diurnal in its habits. Their appearance in life suggests that of an *Arvicola.*

18. **Mus rattus** *Linn.*—A single specimen was captured at a neighboring cacao estate, and was the only one observed.

19. **Mus alexandrinus** *Geoffr.*—Common in the vicinity of houses, and on two occasions captured at a small uninhabited palmetto thatch in a forest.

20. **Mus musculus** *Linn.* — Common at Port-of-Spain, and probably occurs throughout the island. The presence of cats and dogs at the rest-house doubtless prevented the occurrence there of either of the three species of *Mus.*

21. **Heteromys anomalus** (*Thompson*).—This species was originally described by Thompson in 1815,[1] from a single specimen from the island of Trinidad. Few examples appear to have as yet fallen into the hands of naturalists, and even the people of Trinidad are almost unaware of its existence. According to Mr. Oldfield Thomas (Journ. Trinidad Field Nat. Club, I, 1892, p. 165), the type and one other specimen, the latter received in 1891, are in the collection of the British Museum. It is therefore gratifying to report that the present collection contains a series of 30 specimens, including five in alcohol. Both sexes and all ages are represented, from the suckling young to aged adults. From this material the species may be redescribed as follows:

Adult.—Above grayish dusky brown faintly washed with chestnut; below pure white to the base of the hairs. The dark color of the upper surface is sharply defined against the white of the lower surface, without any trace of the fulvous lateral line seen in most of the northern species. Outer surface of the fore and hind limbs like that of the adjoining portions of the body; inner surface white, except that the dusky color of the outer surface completely encloses the middle portion of the fore arm and a short space on the leg at and just above the ankle. Upper surface of all the feet white. Palms flesh-color, soles blackish, both entirely naked. Ears large, for a member of this genus, flesh-colored at the base, passing into blackish apically, which is the color of most of the exposed portion. Tail considerably longer than the body, sharply bicolor, dusky above and whitish below, naked and nearly tuftless at the end, the very short hairs scarcely at all concealing the annulations.

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[1] Trans. Linn. Soc. London, XI, 1815, p. 161, pl. x.

The pelage of the dorsal surface consists largely of grooved spines, almost wholly so over the greater part of the back, mixed sparingly with fine bristly hairs; on the sides of the body the spines are weaker and fewer, here, as below and on the head, the pelage consisting of rather coarse stiff hairs more or less profusely mixed with softer hairs. The whole pelage above, spines as well as hairs, is whitish basally, passing into blackish and tipped generally with very pale bay or chestnut. The flanks and limbs, however, are rather paler and grayer than the middle region of the back.

Measurements.—The average and extreme measurements of ten fully adults, taken in the flesh, are as follows: Total length, 280 (265–292) mm.; head and body, 130 (120–142); tail, 150 (135–160); hind foot, 33 (31–35); ear from crown, 14.5 (14–16).

An average adult skull measures as follows: Greatest length, 36; basal length, 28; greatest zygomatic breadth, 26; least interorbital breadth, 13.5; distance between incisors and first molar, 9.5; crown surface of upper molar series, 4.5; lower jaw, length, 20; height at condyle, 12.5.

Young.—Nursing to half or two-thirds grown young are dusky plumbeous with a slight sooty tinge, but otherwise marked as in the adult. At a more advanced stage the general color becomes a little lighter or grayer, with a faint tinge of brown. The hair on the middle of the back becomes coarser and stiffer, but well-developed spines do not appear much before the animal attains adult size.

The only other species of this genus available for comparison with the present is *Heretomys alleni*, of which the Museum has now a large series, collected in the vicinity of Brownsville, Texas. This proves so distinct from *H. anomalus* that no comparison between the two is necessary, except that it seems desirable to improve the present opportunity to elucidate further the characters of *H. alleni.*[1] The youngest specimen (about half-grown) of *H. alleni* indicates that the young, even during the suckling stage, are not greatly different in general coloration from the adults, being perhaps a little paler and more uniform gray, and not blackish plumbeous as in *H. anomalus.* A series of adults of *H. alleni*, measured in the flesh, give the following dimensions: Total length, 250 (238–260) mm.; head and body, 122 (112–135); tail, 128 (115–136); hind foot, 29 (28–30); ear from crown (measured from the dried skin), 10.

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[1] See this Bulletin, III, No. 2, pp. 268–272, June, 1890.

In general, *H. alleni* differs from *H. anomalus* in its much smaller size, in the very much smaller ears, in the tail being hairy and slightly tufted, and radically in coloration, *H. anomalus* being very much darker at all ages, and entirely lacking the fulvous lateral line seen in *H. alleni.* In fact, as recently pointed out by Mr. Oldfield Thomas (Ann. and Mag. Nat. Hist., 6th Ser., XI, 1893, p. 329), these two species belong to very different sections of the genus,[1] in respect especially to the character of the hind feet, *H. anomalus* belonging to the section having the soles naked and 6-tuberculate, and *H. alleni* to the section with the soles hairy and 5-tuberculate.

This species made its home beneath the roots of forest trees. The pouches are used to carry food. One specimen had no less than fifty-three seeds the size of peas in its pouches, while the pouches of most of the specimens captured contained a few kernels of the corn used as bait which they had stored away before springing the trap.

22. Loncheres guianæ *Thomas.*

Loncheres guianæ THOMAS, Ann. and Mag. Nat Hist. 6th Ser. II, 1888, p. 326 (Demerara); Journ. Trinidad Field Nat. Club, I, No. 7, 1892, p. 166 (Trinidad).

This species is represented by five specimens, all females, and all taken in the mangroves at the mouth of the Caroni River. Four are adult, the other is a half-grown young one. One of the specimens was collected by Mr. Chapman, April 29, 1893, and the others, taken June 10 and 11, were collected and presented to the Museum by Messrs. F. W. Urich and R. R. Mole, of Port-of-Spain. Three of the adults are skins, with the skulls; the other two specimens are skins preserved in alcohol. The June adults all contained fœtuses, two of which are preserved in alcohol.

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[1] Mr. Thomas, however, appears not to have had full-grown specimens of *H. alleni*.

These specimens are provisionally referred to this species, with the description of which they appear sufficiently to agree as regards the general external characters. There are, however, some discrepancies in respect to measurements. The dimensions of an adult female (No. $\frac{6000}{4727}$), measured in the flesh, are as follows: Total length, 456 mm.; head and body, 231; tail, 225; hind foot, 43; ear from crown, 15.

Three skins measure as follows:

	Total length.	Head and body.	Tail.	Hind foot.	Ear.	
6311. ♀ ad.	430	230	200	36	7	Dry.
6312. ♀ "	410	230	180	36	7	"
6309. ♀ "	....	235	165[1]	38	11	In alcohol.

Mr. Thomas's measurements of the type, from Demerara, taken from the skin, are as follows: "Head and body, 190 millim.; tail, 167; [hence, total length, 357;] hind foot, 36.2; ear (contracted), 5.5."

Hence Mr. Thomas's type, though said to be adult, is a much smaller animal than either of our Trinidad specimens, if we restrict our comparisons to the skins. The measurements of the skulls of the Demerara and Trinidad specimens would seem to indicate that this discrepancy is more apparent than real, as shown by the following:

No.	Basal length.	Greatest breadth.	Length of Nasals.	Least interorb. breadth.	Diastema.	Length of Upper molar series
$\frac{6000}{4727}$	50	26	17	13	11.7	11.2
$\frac{6312}{4546}$	40	23	16	11.5	10	10.5
$\frac{6311}{4544}$	43	25	17.5	13	11.5	11
Demerara....	47	26	15.5	13	11.8	11.2

As noted above, Mr. Thomas has already recorded (l. c.) this species from Trinidad, this being its second known occurrence. Mr. Urich writes concerning the specimens collected by himself and Mr. Mole: "They seem to be particularly plentiful on the Caroni now, especially between the hours of five and seven in the afternoon. The stomachs of all killed contained the fruit of the mangroves, of which there is an abundance at present."

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[1] Tail imperfect—mutilated in life.

23. **Loncheres castaneus**, sp. nov.

Similar in size and proportions to *L. guianæ*, but differing from it in coloration and cranial characters.

External characters.—Thickly spinous except on the ventral surface and limbs, the spines strongly developed over nearly the whole dorsal aspect. General color above orange-tawny, more intense on the front part of the head and at the base of the tail, gradually paler on the sides, everywhere heavily lined with black ; ventral surface isabella color, finely lined with dusky, the line of demarcation between the dorsal and ventral surfaces fairly well defined. Upper and under surface of the limbs respectively similar in color to the adjoining portions of the body ; upper surface of hind feet paler, yellowish gray, becoming nearly clear gray on the toes. Palms and soles naked, blackish. Ears small, rounded, blackish, nearly naked. Tail (in the young) similar to that of *L. guianæ*, finely annulated, well-clothed for a short distance at the base, the remainder nearly naked, the very short, dusky yellowish hairs only partly concealing the annulations.

The dorsal pelage consists of spines mixed with hairs, the spines coarse and heavy over the median dorsal area, gradually becoming thinner and weaker on the sides of the body, passing into grooved bristly hairs on the ventral surface. The spines of the back are plumbeous at base passing into black on the apical half, without orange-rufous tipping on the anterior half or third of the dorsal region, but posteriorly subapically ringed with this color and minutely tipped with black, the orange-rufous subapical ring becoming broader and conspicuous posteriorly. On the sides of the body the spines are nearly uniform plumbeous gray to the tip. The intervening hairs are coarse and bristly, blackish basally and very broadly tipped with orange-rufous, this color usually occupying one fourth to one-third the length of the hair, but with the extreme tip often black.

Measurements.—Head and body (adult female), 245 mm. ; tail,—;[1] hind foot, 40 ; ear from crown, 16. (Measurements from the fresh specimen.) A very young specimen, in alcohol, measures as follows : Total length, 235 ; head and body, 110 ; tail, 125 ; hind foot, 29 ; ear from crown, 11.

Skull.—The skull, in size and proportions, is almost indistinguishable from that of *L. guianæ*, but differs in details, as will be presently noticed. Basal length, 43 ; greatest breadth, 25.5 ; least interorbital breadth, 13 ; length of nasals, 15.5 ; diastema, 11.5 ; length of upper molar series, 11.2.

Type, No. $\frac{6001}{4794}$, ♀ ad., Princestown, Trinidad, April 20, 1893, coll. Frank M. Chapman.

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[1] The tail is lacking.

This species is based on three specimens, an adult female and two young males one-fourth to one-half grown. The adult specimen and the larger of the two young ones are unfortunately tailless, the entire tail having been lost apparently in early life, as happens often with the Trinidad species of *Echimys*, as noted below. The young specimen with a perfect tail shows that this member is relatively of about the same length as in *L. guianæ.*

This species differs from *L. guianæ*, apparently its nearest ally, in the general coloration being much brighter and stronger, the dorsal surface being orange-rufous heavily lined with black instead of pale yellow or yellowish gray rather sparingly lined with black, while the ventral surface is many shades darker. The cranial differences consist in the slightly narrower and shorter anterior palatine foramen; in the slenderer, narrower and posteriorly more extended nasals; in the palatal emargination being bluntly oval instead of sharply V-shaped; in the greater breadth of the basi-occipital; and in the greater slenderness of the ascending maxillary branch of the zygoma.

It is probable that the baits used in trapping were not attractive to this species. The two young specimens were trapped, but the only adult secured was caught by dogs near the banks of a small stream. It was called by the natives, Agouti Rat.

24. Echimys trinitatis, sp. nov.

Similar in size and proportions, and apparently in color, to *E. cayennensis* but in cranial characters and in the distribution of the spines more nearly resembling *E. semispinosus* Tomes.

Adult.—General color above rusty brown, nearly uniform except over a rather broad median dorsal area, where the rusty brown is profusely mixed with black, in some specimens the black prevailing; whole ventral surface pure white to the base of the hairs, except that occasional specimens show traces of a prepectoral dusky color. Ears narrow, rounded at top, slightly hollowed on the posterior border, nearly naked, flesh-colored, broadly margined with dusky. Tail a little shorter than the head and body, well furred for about an inch at the base, the rest practically naked, the annulations scarcely at all concealed by the very short, much scattered whitish hairs, and there is no tendency to a terminal pencil, as in *E. cayennensis.* Palms and soles naked, the latter uniform blackish, the former usually mottled flesh-color and dusky, sometimes one color prevailing and sometimes the other. Upper surface of fore feet grayish brown, becoming lighter on the toes; upper surface of hind feet dusky brown on the inner half, gray or grayish white, varying in different specimens, to pure white on the outer half.

The spines are restricted (in a series of 10 adults) to an oval area on the middle of the back, between the shoulders and the hips, extending laterally on to the sides of the body. The spines are grayish white or whitish at base, passing gradually through gray and dusky gray to black, the exposed portion being black, except on the lateral portions of the spiny area, where the spines are often whitish nearly to the tip.

Measurements (average of five specimens measured in the flesh).—Total length, 446 mm. ; head and body, 244 ; tail, 202 ; hind foot, 50 ; ear from crown, 23. The males average somewhat larger than the females, as shown by the subjoined table.

Young.—One-third grown young (in the 2-molar stage) are blackish above, nearly pure black over the central portion of the dorsal area, paler, brownish black on the sides, where the dusky tint has a purplish or faint vinaceous tinge ; below white, with or without a dusky prepectoral collar, traces of which are sometimes present in the adult. The whole pelage is spineless and soft. When about half-grown (in the 3-molar stage) the sides become faintly tinged with pale rusty brown, and a few weak spines begin to appear in the middle of the back. At a more advanced stage the general coloration above is still dusky brown, with a blackish spiny area over the middle of the back (between the hips and shoulders), with rusty-tipped hairs more or less generally intermixed over the whole upper surface of the body.

Skull.—An average adult skull measures as follows : basal length, 48 mm. ; greatest breadth, 29 ; least interorbital breadth, 13.3 ; length of nasals, 24 ; diastema (distance between incisors and first molar), 14 ; upper molar series, 10. The nasal bones extend considerably beyond the fronto-maxillary suture, and are squarely truncate or slightly rounded on the posterior border. A series of young skulls shows the development of the molar series from two to four teeth.

Type, No. $\frac{5813}{4643}$, ♂ ad., Princestown, Trinidad, April 26, 1893, coll. Frank M. Chapman.

This species is based on a series of 21 specimens—12 adults, five young in the spineless, soft, hairy coat, and four in intermediate stages between the spineless young and the fully adult. Two of these are preserved in alcohol, the rest as skins with the skulls separate. All were taken at Princestown during March and April.

Echimys trinitatis differs from *E. cayennensis*, its nearest geographical congener, in various external characters, notably in the restriction of the spiny area to the central portion of the back, in the less hairy condition of the tail and the entire absence of a hairy pencil at the tip, and also somewhat in coloration, especially in the absence of a pale rufous patch behind the ears. In cranial characters it differs at many points, but it may be sufficient to mention the much greater posterior extension of the nasals, which extend much beyond the fronto-maxillary suture instead of terminating considerably in front of it, as in *E. cayannensis*, in which the axis of this suture is oblique instead of transverse. In other words, the nasals and the direction of the fronto-maxillary suture are about as in *E. brevicauda*, as figured by Günther (P. Z. S., 1876, p. 749). In this respect it also much resembles *E. semispinosus* Tomes, from Ecuador, from which species, however, it differs in its very much larger and very differently shaped ears and much longer tail. It appears to resemble this latter species, however, in the restriction of the spines to the central portion of the dorsal area, in the naked and tuftless tail, and in general features of coloration.

The adults present very little variation in coloration or in external characters beyond that already noted, except that three of the adults were entirely tailless, the loss of the tail having evidently occurred in early life, leaving only a broad cicatrix where the tail joined the body. The young specimens are also quite uniform in general coloration, except that in three there is a broad dusky prepectoral collar, varying in width in different individuals, and represented in others by a broken collar, the two halves failing to meet on the median line.

The principal variations in external measurements in ten adult specimens are shown by the following table :

External Measurements.

Cat. No.	Sex.	Total length.	Head and body.	Tail.	Hind foot.	Ear.
6112[1]	♀	442	242	200	47	22
[illegible]	♂	..	265	..[2]	50	25
[illegible]	♀	..	268	..[2]	50	..
[illegible]	♂	..	260	..[2]	55	26
[illegible]	..	..	..	210[3]	53	..
[illegible]	♀	404	231	173	45	21
[illegible]	♂	491	261	230	53	21
[illegible]	♀	442	242	200	47	22
[illegible]	♀	345	155	190	50	..
[illegible]	♂	450	245	205	53	21

[1] Alcoholic. [2] Tail wanting. [3] Body destroyed by some predatory bird or mammal.

The skulls of course vary greatly according to age, in proportion of parts as well as in size. There is also considerable individual variation, especially in respect to the posterior extension of the nasals. These in some examples pass but little beyond the fronto-maxillary suture, while in others they extend much further. There are also minor variations in other parts, as shown by the following table of measurements of eight adult skulls :

Cranial Measurements.

	$\frac{4638}{5908}$	$\frac{4640}{5910}$	$\frac{4643}{5913}$	$\frac{4646}{5916}$	$\frac{4639}{5909}$	$\frac{4642}{5912}$	$\frac{4644}{5914}$	$\frac{4645}{5915}$
	♂	♂	♂	♂	♀	♀	♀	♀
Total length	62	60.5	61	62	61	56	56	....
Basal length.......	47.5	46	47	48	46	43	...	....
Greatest breadth...	27.5	27.5	27	....	27	26	27	27
Interorb. constric'n.	12.5	12.5	13	12.5	13	12	12.5	12.5
Length of nasals. .	22.5	22.5	21	21.5	22	19	20	20
Diastema..........	13	13	12.5	13.5	13	11.5	12.5	12
Length of upper molar series... (crown surface)	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Length of lower molar series...	9	9	9	9	9	9	9	9
Length of lower jaw	34	34	33	35.5	35	31	33.3	32.3
Height of do. at condyle.....	12.5	12	11.5	13	12.5	11	12	12.5

The tendency in these animals to lose the tails renders an examination of the posterior portion of the vertebral column of the tailless examples a matter of interest. Fortunately this portion of the skeleton of two of the tailless specimens was preserved, and shows that the amputation occurs at the second vertebra behind the posterior border of the pelvis, or just behind the fifth caudal. The first four caudals are normal in size and proportions, and appear to be in a healthy condition ; the fifth caudal is abnormal, the posterior third or half having apparently been lost by absorption. A further interesting fact was noted in skinning the specimens in which the tail was still intact, namely, its easy separation at the fifth caudal vertebra, in several specimens the tail breaking at this point in the process of skinning.

The genus *Echimys* is now for the first time positively shown to be an inhabitant of the Island of Trinidad. It is true that "*Echimys*, sp." is entered in Mr. Thomas's list, but it is given solely on the authority of Verteuil, who mentions two species, namely, "*Echymys chrysuros*" and "*Echymys rufus* (?)." What these are it is impossible to determine, as the names given are not pertinent to any Trinidad animal, and there is no other clue as to what he intended to indicate. Verteuil doubtless knew of the existence of two spiny rats in Trinidad, one of which was probably a *Loncheres* and the other possibly the present species.

This species is known by the native name of Pilori, and by some is considered excellent eating. There are popularly supposed to be two species, one with and the other without a tail. It lives in the forest, making its home in holes in the banks of streams or beneath the roots of trees. Three females contained respectively two, four, and six large embryos.

25. **Synetheres prehensilis** (*Linn.*).—Represented by an adult skull.

The presence of this arboreal species is made known by the nauseating odor it gives forth. This is especially noticeable in the early morning when the air is humid and before the daily trade-winds begin to blow. In walking through the forests at this time it was not unusual to encounter odoriferous strata of air proceeding from individuals of this species. So dense, however, was the parasitic vegetation on the trees in which they conceal themselves, that they were practically invisible from below.

26. **Dasyprocta aguti** (*Linn.*).—Represented by three adult skins and four adult skulls.

The Agouti is a very common animal in the forests near the rest-house. It is diurnal, but is more frequently met with late in the afternoon and early in the morning. It is much hunted for food, the usual method of capture being from a scaffold which the hunter erects near some favorite feeding-place. Here at a height of eight or ten feet, and distant only a few yards from the spot at which the game is expected to appear, the almost worthless guns of the negroes prove effective The Agouti is an exceedingly shy animal. In approaching its feeding-ground it advances with the utmost caution, pausing frequently to listen. In eating it sits erect, holding its food between its front feet.

27. Cœlogenys paca (*Linn.*).—Represented by a single adult male, skin and skull.

The Lape is yearly becoming more rare in Trinidad, and will soon be confined to the less accessible parts of the forests. The fact that hunters in unearthing a Lape, which has been driven into a hole by dogs, frequently encounter the unwelcome Maperire (*Crotalus*), has given rise to the belief among some of the negroes that the hunted Lape flees to the snake's hole for protection. His passage simply arouses the reptile, which is then *en garde* for the hunters and dogs.

28. Cariacus (Coassus) nemorivagus (*F. Cuv.*).—Represented by a skull of an adult male, presented by Mr. R. S. Rowbottom, said to be the skull of one of the largest deer ever killed in the vicinity of Princestown. This skull measures as follows: Basal length (ant. border of premax. to post. border of occip. condyles), 213 mm.; greatest zygomatic breadth, 100; greatest mastoid breadth, 66; length of nasals, 62; anterior border of premaxillæ to front edge of first premolar, 68; length of molar series, 67; length of antler from frontal bone, 109.5; same from anterior base of the burr, 102.5; length of lower jaw (incisive border to posterior border of angle), 172; height at coronoid process, 83; height at condyle, 55.5; length of lower molar series, 73.5.

On the right side of this skull is the alveolus of a small upper canine (diameter 3.3 mm.); but there is no trace of a corresponding alveolus on the left side.

We provisionally follow Mr. Thomas in adopting the above name for the Trinidad deer, in the absense of the necessary material for deciding its relations to the several allied continental species.

These Deer are among the worst enemies to young cacao trees, of which they destroy thousands. Nevertheless, they are protected by a recently enacted law. In view of their abundance and the injury which they cause to agriculture it would seem inadvisable to protect deer until they are so lessened in numbers as not to prove the enemy of cacao growers.

29. Dicotyles.—Two species of this genus have long been recognized as inhabiting the island. One of the species was common near the rest-house, but no specimens were secured.

30. Cyclothurus didactylus (*Linn.*).—One adult female, Princestown, March 18. Measurements: Total length, 490 mm.; head and body, 216; tail, 274; hind foot, 40.

This small Ant-eater, according to popular report, is evidently not uncommon in the forests, where its food is said to consist of the white-ants or termites. Its vernacular name of "Poor-me-one," meaning poor me alone, expresses exactly the sentiment of the indescribably sweet, sad call which, heard only at night, is generally ascribed to this species. This call was frequently heard in the forests near the rest-house during moonlight nights, but the caller was identified only by the negroes' descriptions. We are now informed by Mr. Albert B. Carr, of Trinidad, at present in New York, that the call so generally supposed to be uttered by the ant-eater is in reality the note of a goatsucker, and that he has shot the bird in the act of calling.

The only specimen secured of this ant-eater was purchased alive from some negroes. It was kept alive for several days. During the day it slept holding on to a branch with the aid of its strong fore-claws and prehensile tail. It moved only when disturbed, and as soon as it was permitted relapsed into its former stupor. Just after sunset it raised its head, and, like a sleepy person, rubbed its eyes, using either the front or hind-foot for this purpose. This effort seemed to weary it, for it again rolled itself into a ball and slept. A few minutes later it re-aroused itself, and after rubbing its eyes as before, raised itself on its hind-legs and felt about in the air, uttering a low, whining snuffle and evidently seeing nothing. As darkness increased it seemed to become thoroughly awakened, and climbed slowly up and down its perch, feeling vainly for some way by which to leave it. It released its hold with its tail only when standing on all four feet, and at the first step this member was coiled around a branch as a safeguard in case of a misstep. The tail is so muscular that its grasp could be released with difficulty, while it was almost impossible to dislodge the hold of the long, curved nails of the fore-feet.

31. **Tatusia novemcincta** (*Linn.*).—Signs of this animal were seen in the forests, and part of one was brought by a hunter to the rest-house kitchen. Its flesh proved excellent eating.

32. **Didelphis marsupialis** (*Linn.*).—This species is represented by three specimens, two males and a female, taken at Princestown. They measure as follows :

	Total length.	Head and body.	Tail.	Hind foot.
♂..............	920	455	465	66
♂..............	810	385	425	55
♀..............	740	350	390	55

A common inhabitant of the forests. The pouch of a female contained seven young, each measuring about 50 mm. in length. Two living examples of this species were seen near the Grand Etang in the island of Granada. They were in the possession of two negro boys who had just captured them, and from whom one, an adult female, was purchased.

33. **Didelphis (Philander) philander** *Linn.*—A single, apparently full-grown male (No. $\frac{6943}{4766}$), taken March 9, is provisionally referred to this species. It differs from it, however, in its much smaller size, in the tail being hairy for only an inch and a half at the base (instead of for "from two to three inches"), and uniform grayish brown from base to tip, instead of white for its apical half, as in Brazilian examples. Measurements of the freshly-killed animal are as follows : Total length, 495 mm.; head and body, 210 ; tail, 284 ; hind foot, 34. The Trinidad animal heretofore referred to this species may prove separable from the *D. philander* of the mainland—a point further material must decide.

34. **Didelphis (Micoureus) murina** *Linn.*—Although this species has not been previously recorded from Trinidad, it appears to be at least locally common on the island, it being represented in the present collection by a series of 20 specimens, taken at Princestown.

Sixteen adult males, measured before skinning, range in size as follows: Total length, 361 (340–395) mm.; head and body, 171 (155–189); tail, 190 (175–218); hind foot, 24.4 (20–28); ear, 25 (22–29). Four females measure as follows: Total length, 324 (302–365); head and body, 148 (132–168); tail, 176 (163–197); hind foot, 22 (20–24); ear, 22 (20–23.)

In coloration the variation is chiefly in the brightness of the rufous of the upper parts, which varies from dull grayish brown to quite strong rufous brown, and in the depth of the yellowish white tint below, which varies from buff to ochraceous buff. The younger (at least the smaller) specimens of the series are duller and darker colored above than the larger, older examples.

This little Opossum was so abundant as to prove a positive source of annoyance. Traps baited with meat were sure to be preoccupied by it, while many trapped specimens of other species were partially eaten by probably this species.

LIST OF LAND MAMMALS KNOWN FROM TRINIDAD.

For convenience of reference we here add a list of the land mammals thus far recorded from the Island of Trinidad. It consists of Mr. Thomas's 'Preliminary List,' with the additions made in the present paper. The fourteen species here added are distinguished by an asterisk prefixed to the current number.

Order PRIMATES.

Family CEBIDÆ.

1. *Mycetes*, sp. Probably *M. seniculus* (Linn.). Red Howler.
2. *Cebus*, sp. Sapajou. Capuchin Monkey.

Order CHIROPTERA.

Family VESPERTILIONIDÆ.

3. *Vespertilio nigricans* Wied.
4. *Thyroptera tricolor* Spix.

Family EMBALLONURIDÆ.

5. *Furipterus horrens* (F. Cuv.).
6. *Saccopteryx bilineata* (Temm.).
7. *Saccopteryx leptura* (Schreber).
8. *Saccopteryx canina* (Wied).
9. *Rhynchonycteris naso* (Wied).
10. *Noctilio leporinus* (Linn.). Fish-eating Bat.
11. *Molossus rufus* Geoff.
12. *Molossus obscurus* Geoff.

Family PHYLLOSTOMATIDÆ.

13. *Chilonycteris rubiginosa* Wagn.
14. *Pteronotus davyi* Gray.
15. *Mormops megalophylla* Peters.
16. *Lonchorina aurita* Tomes.
17. *Mycronycteris megalotis* (Gray).
18. *Phyllostoma hastatum* (Pall.).
19. *Hemiderma brevicaudum* (Wied).
20. *Glossophaga soricina* (Pall.).
21. *Anoura geoffroyii* Gray.

*22. *Chœronycteris intermedia* All. & Chapm.

23. *Artibeus perspicillatus* (Linn.).
24. *Artibeus planirostris* (Spix).
25. *Artibeus hartii* Thos.
26. *Artibeus quadrivittatus* Peters.
27. *Vampyrops caraccioli* Thos.
28. *Chiroderma villosum* Peters.
29. *Sturnira lilium* (Geoffr.).
30. *Desmodus rufus* Wied. Blood-sucking Bat.

Order CARNIVORA.

Family FELIDÆ.

31. *Felis*, sp. Ocelot. Tiger-cat.

Family MUSTELIDÆ.

32. *Galictis barbara* (Linn.). Wood-dog.
33. *Lutra insularis* F. Cuv. Otter.

Family PROCYONIDÆ.

34. *Procyon cancrivorus* (Cuv.). Mangrove-dog.
35. *Cercoleptes caudivolvus* (Pall.). Kinkajou.

Order RODENTIA.

Family SCIURIDÆ.

36. *Sciurus æstuans hoffmanni* Peters. Squirrel.

Family MURIDÆ.

37. *Holochilus squamipes* (Brants).
*38. *Nectomys palmipes* All. & Chapm.
*39. *Tylomys couesii* All. & Chapm.
*40. *Oryzomys speciosus* All. & Chapm.
*41. *Oryzomys trinitatis* All. & Chapm.
*42. *Oryzomys velutinus* All. & Chapm.
*43. *Oryzomys brevicaudus* All. & Chapm.
*44. *Abrothrix caliginosus* (Tomes).
*45. *Mus rattus* Linn. Black Rat.
*46. *Mus alexandrinus* Geoffr. Roof Rat.
*47. *Mus musculus* Linn. House Mouse.

Family HETEROMYIDÆ.

48. *Heteromys anomalus* (Thompson). Pouched Rat.

Family OCTODONTIDÆ.

49. *Loncheres guianæ* Thos. Spiny Rat.
*50. *Loncheres castaneus* All. & Chapm. Agouti Rat.
*51. *Echimys trinitatis* All. & Chapm. Pilori.

Family HISTRICIDÆ.

52. *Synetheres prehensilis* (Linn.). Porcupine.

Family DASYPROCTIDÆ.

53. *Dasyprocta aguti* (Linn.). Agouti.
54. *Çœlogenys paca* (Linn.). Lape.

Order UNGULATA.

Family CERVIDÆ.

55. *Cariacus* (*Coassus*) *nemorivagus* (F. Cuv.). Deer. Biche.

Family DICOTYLIDÆ.

56. *Dicotyles tajacu* (Linn.). Collared Peccary. Quenk.
57. *Dicotyles labiatus* Cuv. White-lipped Peccary. Quenk.

Order EDENTATA.

Family BRADYPODIDÆ.

58. *Cholœpus didactylus* (Linn.). Two-toed Sloth.

Family MYRMECOPHAGIDÆ.

59. *Myrmecophaga jubata* Linn. Great Ant-eater.
60. *Tamandua tetradactyla* (Linn.). Tamandua.
61. *Cyclothurus didactylus* (Linn.). Little Ant-eater. Poor-me-one.

Family DASYPODIDÆ.

62. *Tatusia novemcincta* (Linn.). Armadillo. Tatou.

Order MARSUPIALIA.

Family DIDELPHIIDÆ.

63. *Didelphis marsupialis* Linn. Manicou.
64. *Didelphis* (*Philander*) *philander* Linn. Manicou gros yeux.
*65. *Didelphis* (*Micoureus*) *murina* Linn. Manicou gros yeux.

Article XIV.—DESCRIPTION OF A NEW SPECIES OF OPOSSUM FROM THE ISTHMUS OF TEHUANTEPEC, MEXICO.

By J. A. ALLEN.

Didelphis (Micoureus) canescens, sp. nov.

Didelphys (*Micoureus*) *murina* ALLEN, Bull. Am. Mus. Nat. Hist. III, p. 190, Dec. 1890. (Not *D. murina* LINN.)

Smaller even than *D.* (*M.*) *murina*, with the general coloration of *D.* (*M.*) *grisea*. Pelage short, close, thick. Tail furred at the base as in *D. murina*.

Above ashy brown, in some specimens with a slight rufescent tinge. Below white, tinged with pale yellow. A broad blackish eye-ring, produced forward nearly to the nose; between the eyes, sides of the face and sides of the neck yellowish gray, much lighter than the back. Ears broad, rounded, naked, pale brown in the dried skin, probably more or less yellowish in life. Tail slightly longer than head and body, the basal half-inch heavily furred, the rest naked, pale brown, uniform or varied with spots of flesh-color. Feet grayish or yellowish white, thinly haired on the upper surface.

Measurements of three males and two females (approximate, from skins): Three males, total length, 283 (266–288) mm.; head and body, 137 (134–138); tail, 146 (142–150); hind foot, 65 (60–70); ear, about 65. Two females, total length, 256 (249–268); head and body, 118 (114–126); tail, 138 (134–142); hind foot, about 60; ear, about 60.

The skull is much smaller than in *D. murina*, with the nasals less expanded posteriorly, the small posterior palatal vacuities absent, and the triangular projecting ledges of the interorbital region much more strongly developed, quite as much so as in *D. cinerea*. An average adult male skull measures as follows: total length, 35.5; basal length (front edge of premaxillaries to posterior border of occipital condyle), 33.8; greatest zygomatic breadth, 20.8; tip to tip of postorbital processes, 10.4; length of nasals, 16.3; from anterior border of premaxillaries to posterior border of palatal floor, 18.8; length of lower jaw (incisive border to posterior border of condyle), 26; height at condyle, 7.6; height at coronoid process, 11.7.

Type, No. $\frac{3111}{2482}$, ♂ ad., Santo Domingo de Guzman, Isthmus of Tehuantepec, Mexico, April 30, 1890, coll. Dr. A. C. Buller.

This species is based on a series of three adult males, two adult females, and a full-grown but rather young male, collected by Dr. A. C. Buller at Santo Domingo de Guzman, Isthmus of Tehuantepec, Mexico, April 25–May 2, 1890, and formerly referred by me (l. c.) provisionally and with much doubt to *D. murina*, in the absence of specimens of *D. murina* for comparison. The recent acquisition of a large series of that species shows at once that they are widely different, both externally and in cranial characters, as already indicated. It now seems strange that a species so strongly marked should so long have escaped observation.

The only species with which *D. canescens* apparently needs comparison is *D. waterhousei* Tomes,[1] from Galaquiza, Ecuador, judging from Tomes's description ; but Mr. Thomas (Cat. Marsup. and Monotrem., p. 342), after an examination of the type, refers this species to *D. cinerea*. Mr. Thomas records the type (l. c., p. 343) as an immature skin and skull ; but Mr. Tomes described the species from an adult female, *which had young in her pouch* (*cf.* P. Z. S., 1860, p. 60), and later (*cf.* P. Z. S., 1860, p. 217) gives a detailed description of another specimen, likewise an adult female. Besides the marked discrepancies in size and proportions between Tomes's measurements and those given by Thomas for *D. cinerea*, and in the length of the basal furred portion of the tail, Mr. Tomes states that *D. waterhousei* is a *pouched* species, while Mr. Thomas says of *D. cinerea*, "*pouch absent.*"

D. canescens, while resembling *D. cinerea* very much in coloration, is apparently fully one-third smaller, with a relatively considerably shorter tail, furred only for about the basal half-inch. While all of the six specimens are full-grown, three of them are obviously quite old.

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[1] P. Z. S., 1860, pp. 58, 217 and 303 (fig. of skull), pl. lxxvi (animal).

Article XV.—FURTHER NOTES ON COSTA RICA MAMMALS, WITH DESCRIPTION OF A NEW SPECIES OF ORYZOMYS.

By J. A. ALLEN.

In a former volume of this Bulletin (Vol. III, pp. 203–218, April, 1891) will be found a paper entitled 'Notes on a Collection of Mammals from Costa Rica,' based on collections received from the Museo Nacional de Costa Rica, through the kindness of Don Anastasio Alfaro, Director of the Museum, and Mr. George K. Cherrie, the Acting-Curator of Mammals, Birds and Reptiles. Another small collection has been since received from the same source, which adds eight species to the 38 given in the previous list, and contains additional specimens of other species of special interest. The present collection numbers about 50 skins, each with the skull separate, representing 17 species. I also take this occasion to record an additional species of Costa Rican Bat recently presented to the Museum by Mr. José C. Zélédon, making in all 9 species additional to those of the previous list. These are distinguished by an asterisk prefixed to the current number.

1. **Atalapha frantzii** *Peters.*—One adult male, San Sebastian. (San José), Oct. 8, 1891, George K. Cherrie.

*2. **Rhogeëssa parvula** *H. Allen.*—Three specimens, Pacific coast of Costa Rica, J. C. Zélédon.

*3. **Saccopteryx bilineata** (*Temm.*).—Two specimens, male and female adult, Jimenez, August, 1891, A. Alfaro.

*4. **Diclidurus albus** *Wied.*—One specimen, La Palma (San José), August, 1890, George K. Cherrie.

*5. **Nyctinomus brasiliensis** *I. Geoffr.*—One specimen, male, San José, June 22, 1891, George K. Cherrie.

6. **Hemiderma**[1] **brevicaudum** (*Wied*).—Five specimens, two males and three females, San Sebastian, San José, August, 1891.

*7. **Artibeus cinereus** (*Gerv.*).—Two adult females and an additional adult skull, San Sebastian, San José, August, 1891.

8. **Artibeus carpolegus** *Gosse.*—One adult male and five specimens more or less immature, as shown by the skulls. The adult male was taken at San José, June 21, 1891, the immature examples at Limon, May 27, 1891, all collected by Mr. Cherrie. The single adult male has faint whitish head-stripes; in the immature examples there is no trace of head-stripes; and the coloration of the pelage everywhere is darker—slaty black instead of browish black—and the measurements are all much smaller. As regards external characters, the young might be readily mistaken for a distinct species; the skulls, however, show them to be simply immature examples of *A. carpolegus*.

*9. **Vampyrops lineatus** *Geoffr.*—One specimen, adult female, Jimenez, Sept. 9, 1891, A. Alfaro.

*10. **Blarina micrura** (*Tomes*).—One specimen, San Isidro, San José, Sept. 25, 1891, Geo. K. Cherrie.

11. **Sigmodon hispidus toltecus** (*De Sauss.*).—One specimen, adult male, San José, November, 1890, Geo. K. Cherrie.

12. **Abrothrix teguina** (*Alston*).—Two males and a female, La Carpintero, Sept. 2, 1891, Geo. K. Cherrie.

13. Sitomys cherriei *Allen.*

Hesperomys (*Vesperimus*) *cherrii* Allen, Bull. Am. Mus. Nat. Hist. III, p. 211, April 17, 1891.

This species is represented by a series of 15 specimens, including immature examples as well as adult. There is little, however, to add to the description of the species already given (l. c.). They are all from La Carpintero, the original locality, taken July 15-26, 1891, by Mr. Cherrie.

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[1] *Hemiderma* Gervais, 1855=*Carollia* Gray, 1838, preoccupied.

14. Sitomys nudipes *Allen.*

Hesperomys (Vesperimus) nudipes ALLEN, Bull. Am. Mus. Nat. Hist. III, p. 213, April 17, 1891.

Two specimens, Santa Clara, A. Alfaro. Both are immature and differ from the type (see this Bulletin, l. c.) in being much darker, especially above, as would be expected in the young. Above the pelage is black with a faint tinge of sooty brown, passing into grayish black on the sides, and then into the purer gray of the ventral surface, which is tinged more or less with yellowish rusty over the pectoral region. The ears and tail are naked, and the abruptly whitish feet are thinly haired.

An adult skin and skull, from near San José, collected and presented to the Museum by Mr. George K. Cherrie since the publication of the original description, agrees with the type.

This is an aberrant *Sitomys*, but the species seems to belong here rather than elsewhere.

*15. Oryzomys costaricensis, sp. nov.

Size very small; ears small; tail one and a half times the length of the head and body. Pelage full, long (7 mm. on middle of back), soft, but rather coarse for so small a mouse.

Above yellowish brown, varying to yellowish chestnut, with a heavy admixture of black hairs; sides paler, ochraceous buff with little or no black, passing gradually into the clear, rather strong buff of the ventral surface, which is separated from the color of the upper parts by a quite distinct but narrow fulvous lateral line. Ears small (height above crown, in dried skin, about 7 mm.), oval, well haired on both surfaces, dusky brown externally, darkest on the anterior third, more yellowish on the inner surface. Upper surface of fore and hind feet buffy white, scantily haired, especially the hind feet, where the short light-colored hairs scarcely conceal the scaly annulations; palms and soles naked, flesh-colored, the latter 6-tuberculate. Tail very long, naked, unicolor, pale brown.

Total length, 196 mm.; head and body, 79; tail, 117; hind foot, 23 (average of three specimens, from measurements made before skinning); ear from crown, 7 (from skins).

The skull is that of a nearly typical species of *Oryzomys* in all of its essential features, except that the supraorbital ridge is so feebly developed as to be quite lacking, even in a skull with well-worn teeth. An adult skull measures as follows: Total length, 21 mm.; basal length, 17.8; greatest zygomatic breadth, 11.4; greatest breadth of brain case, 10.1; least interorbital breadth, 4.3 ; length of nasals, 8 ; interparietal, length, 2 ; interparietal, breadth, 8.4 ; incisors to first premolar, 2.5 ; length of upper molar series, 3 ; length of lower jaw, 11.7 ; height of same at condyle, 4.3.

Type, ♀ ad., El General, altitude 2150 feet, Feb., 1891, coll. H. Pittier.

This species is based on four specimens, all nearly or quite adult (in one the teeth are well-worn), three of them taken on El General at an altitude of 2150 feet, and one in the Cerro de Buena Vista, "altitude 10,342 feet," in February, 1891, by H. Pettier. Another specimen, labeled "La Carpintera, ♀, July 26, 1891, Geo. K. Cherrie," I also refer to the same species. This would seem to give the species quite a range in altitude, if the elevation recorded on the labels is correctly indicated. These are all skins, four of which are accompanied by their separate skulls.

Oryzomys costaricensis needs comparison with no other species described from north of the Isthmus of Panama. It is well characterized by its very small size (head and body three inches or less) and its exceedingly long tail (nearly five inches). In size, coloration and general external appearance it is strongly suggestive of a very long-tailed species of *Reithrodontomys*, but the resemblance is entirely superficial. Its nearest representative appears to be *Oryzomys longicaudatus* (Benn.), of Chili and Peru, from which, however, it is obviously distinguished by its small ears and different coloration. The absence of the usual supraorbital 'bead' may be easily due to the very small size and consequent delicate structure of the species.

***16. Oryzomys couesi** *Alston.*—One specimen, female, Bahia de Salinas (on the Pacific coast), July, 1890, A. Alfaro. Skin and skull, from an alcoholic specimen, with the following measurements inscribed on the label: "Length, 9.15 in. [232 mm.]; tail, 5.35 [135.6]; hind foot, 1.17 [29.7]." This specimen is provisionally referred to *O. couesi* Alston, as recently redefined by Thomas (Ann. and Mag., 6th Ser., XI, 1893, p. 403).

17. Lepus gabbi *Allen.*—One specimen, San José.

18. Didelphis (Micoureus) murina *Linn.*—One specimen, a half-grown male, Jimenez, August, 1891, A. Alfaro.

Article XVI.—DESCRIPTIVE CATALOGUE OF THE BUTTERFLIES FOUND WITHIN FIFTY MILES OF NEW YORK CITY, TOGETHER WITH A BRIEF ACCOUNT OF THEIR LIFE HISTORIES AND HABITS.

By William Beutenmüller.

The present paper is based upon the list of butterflies given by me in my 'Catalogue of Lepidoptera found within fifty miles of New York City, with their Food-plants,' published in the Annals of the New York Academy of Sciences, Vol. V, 1890, pp. 199–230, and is the beginning of a series of similar papers on the moths of the region which I intend soon to publish. The descriptions of the species in this work have been made from specimens contained in the collection of the American Museum of Natural History, viz.: S. L. Elliot, James Angus and Henry Edwards Collections, and also from material collected in this vicinity by me for the Museum during the past four years. The earlier stages have been described either from living specimens or have been condensed from the writings of W. H. Edwards, S. H. Scudder, and others. Free use has also been made of Prof. John B. Smith's 'Catalogue of Insects found in New Jersey,' and Wm. T. Davis's 'List of Butterflies found on Staten Island.'

PAPILIONIDÆ.

Subfamily PAPILIONINÆ.

Papilio ajax *Linn.*

Butterfly.—Pale green with black borders and transverse markings. Hind wings with a red spot on the anal angle; tails black, long. Expanse, 2½ to 3½ inches.

Caterpillar.—Gray with white, black and yellow transverse bands on the fourth and fifth segments, and the segments after the fifth with a yellow and two dull white bands; sometimes the larva is green and each segment crossed by gray, yellow and blue bands; sometimes the larva is pale green with blue, black and yellow bands. Length, about 1½ inches.

Chrysalis.—Bright green or light brown, with a few darker markings. Head-case with short prominences and a triangular process on the thorax, which has a median carina and a similar pair at the sides of the body. Length, 1 inch.

Food-plant.—Paw-paw.

Only a few occasional specimens have been seen flying in this vicinity, and the occurrence of the insect here is probably accidental. It is common in the Southern and Western States.

Papilio philenor *Linn.*

Butterfly.—Velvety black with greenish or bluish metallic reflections. Fore wings with a row of whitish spots near the outer margin. In some specimens these spots are sometimes absent. Hind wings have also a row of five or six whitish spots, which are more prominent than those on the fore wings. Tails black. The underside of the hind wings have a row of seven large orange spots which are surrounded with black, and also a row of cream-colored semilunate spots along the outer margin; the spots decreasing in size as they reach the inner angle. Expands 3 to 3½ inches.

Caterpillar.—Velvety black with long black and orange fleshy tubercles and orange spots. Length, 2 inches.

Chrysalis.—Yellowish green, marked with gray and violet, with more or less yellow on the back. Length, 1½ inches.

Food-plant.—Dutchman's Pipe (*Aristolochia*).

Rather common in this vicinity, but is rather local owing to the scarcity of the food-plant. May be found in May and June, and again in August and September, in gardens and open places in woods. Double brooded.

Papilio asterias *Fabr.*

Plate II, Fig. 1.

Butterfly.—Black with two bands composed of yellow spots on each wing. The spots of the inner band much larger than the outer ones. Hind wings with blue lunules or dashes between the yellow bands. Anal spot round with a black spot in the centre. In the female the yellow spots are much smaller and the blue lunules very prominent. On the underside the markings are similar to those above, but the yellow spots are more or less orange instead of light yellow. Expands 3 to 4 inches.

Var. **calverlyii** *Grote.*—Black with the outer half of wings yellow, with a narrow black outer margin, including the tail on the hind wings. Underside, with outer half of wings, orange.

Caterpillar.—Bright pea green, with a transverse black band on each segment, containing a row of yellow spots. Length, 1½ inches.

Chrysalis.—Dirty yellowish brown or light yellowish, more or less dotted with black and marked with griseous. Head-case with two projections directed forward. Length, 1¼ inches.

Food-plants.—Parsley, Parsnip, Celery, Carrot and other allied plants.

Very common in open fields, especially where wild parsnips grow, from May to October, but is most numerous in August. Double brooded. A single specimen of the curious variety *calverlyii* was taken at New Lots, Queens Co., L. I., in August, 1863.

Papilio troilus *Linn.*

Butterfly.—Black; fore wings with a row of pale greenish yellow spots near the outer margin; and sometimes traces of another row of very small spots in front of this row. Hind wings with a row of green lunules close to the outer margin, the upper spot being orange. Across the middle is a band-like cloud composed of green scales, beyond which the scales gradually become thinner as they reach the green lunules. In the female these scales are blue and somewhat of a metallic color. Underside with two rows of small yellowish or greenish spots on the upper wings near the outer margin, and two rows of large orange spots on the hind wings; space between the orange spots thickly scaled with blue and green. Body black with two rows of small yellow spots on each side. Expands 3½ to 3¾ inches.

Caterpillar.—Green above, with four small blue spots on each of the segments from the 6th to the 11th. A yellow band along the sides and a transverse yellow band edged with black on the anterior part of the first segment. On the third segment are two very large yellow eye-like spots edged with black, and a large black spot filling the lower part. On the fourth segment are two more somewhat smaller eye-like spots. Length, 1¾ inches.

Chrysalis.—Head-case with two prominences, projecting forward. Sides with an elevated ridge; thorax with a short, pointed elevation. Wing-cases much elevated in the middle. Color, orange, green or pale brown, with a few brownish spots. Length, 1⅛ inches.

Food-plant.—Spice-bush (*Lindera*) and Sassafras.

Common during the latter part of May and June, and again in August. Double brooded. Found in open, sunny spots and along wood paths. The larva spins a silken web on a leaf, and its habits are like those of the following species.

Papilio turnus *Linn.*

PLATE II, FIG. 2.

Butterfly.—Yellow ; upper wings with a transverse black band near the base and followed by three shorter stripes not extending across the wing. Costa narrowly edged with black and the outer margin with a broad black band in which is a row of small yellow spots. Hind wings also broadly margined with black from the apex to the inner angle, with a row of yellow crescent-shaped spots near the outer edge, the first and last spot orange, as is also the spot on the anal angle. In the black margin are a few blue scales in the male, and in the female thickly scaled ; the scales forming a series of regular lunules. Along the inner margin is a narrow band which unites at the end with a band of the same color running to the costa about one-third from the base. Expands 3½ to 4½ inches.

Female aberration, **glaucus** *Linn.*—This form is sooty brown instead of yellow, with the black markings faintly visible. The yellow spots near the outer margins of the upper and hind wings remain the same, and the hind wings are more heavily scaled with blue.

Caterpillar.—Head purplish brown. Body bright green above, whitish beneath. On each side of the third segment is a suboval, greenish, yellow patch edged with black, and enclosing a purple spot. On the junctions of the fifth and sixth segments is a transverse, narrow, yellow and velvety-black band. Along the body are also rows of small blue spots. Length, 1½ to 1⅘ inches.

Chrysalis.—Grayish brown, mottled and streaked with brown, green and black ; on the back of the body are two rows of blunt tubercles, four in each row ; on the thorax is a blunt process projecting forward, and on the head-case are two processes. Length, 1½ inches.

Food-plants.—Apple, Quince, Plum, Thorn, Cherry, Birch, Basswood, Ash, Alder, Willow, Oak, Tulip-tree, etc.

This butterfly inhabits all sections of the United States, from the Atlantic to the Rocky Mountains, also British America and Newfoundland. In the vicinity of New York City it is common and is double brooded, the first brood appearing in the latter part of May and June, and the second brood in July and August. The female lays her eggs singly on the upper surface of a leaf, and the young caterpillar takes its abode on the same side, reposing on a bed of silk, which it spins for the purpose, and going to the edge to feed when disposed. As it increases in size the leaf is somewhat drawn together, making it difficult to discover the caterpillar. When fully grown it changes from green to brown, and at this stage deserts the tree to form its chrysalis. The caterpillar may be found in July and September.

Papilio cresphontes *Cramer.*

Butterfly.—Sooty black with a series of large rounded spots running obliquely across the wings from the apex to near the base; from about the middle of this row begins a row of three spots which run to the hind angle. Hind wings with a rather broad yellow band across the base and a series of large yellow spots running from the apex to the inner angle. Anal spot black, with a red bar and a few blue scales. Tails black, with a large oval spot near the tip. Underside almost entirely yellow, with an orange patch at the end of the discal cell in the hind wings, which also have a series of blue lunules across the middle in the black ground. Expands 4 to 5¼ inches.

Caterpillar.—Dark brown with a white band on each side extending from the head to a large whitish patch, mottled with olive and brown. At the end of the body is also a patch of the same color. Several whitish rings are scattered over the body, especially on the anterior segments. Length, 2 inches.

Chrysalis.—Brown, sometimes tinged with green, and more or less marked with dark brown. Body roughened and a little bent; wing-cases protuberant beneath, all the larger projections anterior and directed forward. Length, 1½ inches.

Food-plants.—Hop-tree (*Ptelea*), Prickly Ash, Orange and *Dictamnus fraxinella.*

In this vicinity this insect is quite rare, and the larva feeds on the hop-tree. But in the South it is one of the commonest butterflies, and is seen everywhere flitting about in the orange groves. In Florida, where the insect abounds very plentifully, it is a pest to the orange, and, on account of the large size and voracity of the caterpillar, it is commonly known as the 'Orange Dog.' It does considerable damage, especially to young trees, which are sometimes completely defoliated.

The female deposits about five hundred eggs; she scatters them over a wide area, seldom laying more than four or five upon a single plant. In the vicinity of New York there are two broods—the first in June and the second in August.

Synopsis of the Species of Papilio.

With long tails:
    Pale green, with black borders and markings ....*P. ajax.*
With short tails:
    Ground color black.
        With greenish or bluish metallic reflection. ....*P. philenor.*
        With bands composed of yellow spots................. *P. asterias.*
        Hind wings thickly covered with green scales.............*P. troilus.*
        With yellow spots and a broad yellow band near the base of
            the hind wings ....*P. cresphontes.*
    Ground color yellow.
        With black bands and stripes..................... ...*P. turnus.*

Subfamily PIERINÆ.

Pieris rapæ (*Linn.*).

PLATE II, FIG. 3.

Butterfly.—Wings white with a blackish patch at the apex of the fore wings and a small black spot a little beyond the middle. Hind wings with a black spot on the costa beyond the middle. Base of all the wing dusted with blackish scales, more so in the female, which differs from the male in having two black spots on the fore wings instead of one. Underside of fore wings white, with the apex yellow and with two black spots. Hind wings yellow, with a few black scales. Expands 1⅜ to 1⅞ inches.

Caterpillar.—Pale green, with a narrow stripe along the middle of the back and a row of yellow spots along the sides. The body is also finely dotted with black. Length, about 1 inch.

Chrysalis.—Varies in color from a dull greenish to light gray, or brown, with a number of black points. Length, ⅞ inch.

Food-plants.—Cabbage, Turnip, Mignonette, and other allied plants.

This species is an importation from Europe, and is exceedingly common in this vicinity from May until November. It may be seen everywhere, in pastures, gardens and other places, but especially in cabbage-fields, to which plant the insect is very injurious. Three brooded.

Pieris protodice (*Bdv.*).

PLATE II, FIG. 4.

Butterfly.—Upper wings white, with a large black spot at the end of the discal cell, and a submarginal row of three spots running across the wing. At the outer margin is a row of black dashes. Hind wings without marking but slightly showing traces of the marking beneath. Underside of upper wings same as above. Hind wings with the veins more or less broadly margined with blackish or greenish yellow. In the female all the markings are much heavier. The three spots across the fore wings are connected with the dashes along the outer margin. Hind wings with a zig-zag band near the outer border, which is connected with the subtriangular spots along the margin, and each enclosing a diamond-shaped spot. The base of the wings to nearly the middle is also heavily marked with grayish scales. The markings on the underside of the fore wings are repeated but not so heavily as above; the apex is tipped with yellow. Hind wing with the veins broadly bordered with yellowish green, and the zig-zag band and spot along the outer margin is of the same color. In the spring brood the markings are more or less distinct, and are often, especially in the males, quite obliterated. Expands 1⅜ to 2 inches.

Caterpillar.—Green, with two longitudinal yellow stripes along each side, and interrupted on each segment by two blue spots. Each segment has six transverse wrinkles, on each of which is a row of different sized round, piliferous spots, those on the first and fourth wrinkle being the largest; from each of these spots arises a short black hair. The head is green, with black spots and usually with a yellow patch on each side. Length, about 1⅙ inches.

Chrysalis.—Much the same as that of *Pieris rapæ*, varying in color, but is usually bluish gray, sprinkled with black. The ridges and other prominences are edged with buff or flesh color. Length, ¾ inch.

Food-plant.—Cabbage, *Erigeron canadense*, etc.

This butterfly was common in former years about New York, but since the introduction of the imported Cabbage Butterfly (*Pieris rapæ*) it has disappeared almost entirely, in fact only a few single examples have been taken within the last ten years. It is yet quite abundant in southern New Jersey. In 1886 I captured in Camden about two hundred specimens inside of two hours. It is also common in the Southern and Western States.

Pieris oleracea (*Harris*).

Butterfly.—This species may be readily distinguished from its allies by the absence of the black spots on the wings. It is pure white, with a few black scales at the base of the wings. On the underside it is pale yellow with the veins more or less dusted with blackish scales. Expands 1¾ to 2 inches.

Caterpillar.—Body pale green covered with fine, short, sordid white hairs; a darker green dorsal line. Length, 1 inch.

Chrysalis.—Shape and size same as in the preceding species, and varies from a dirty whitish to greenish, regularly dotted with black. Length, ¾ inch.

Food-plants.—Cabbage, Turnip, Mustard, Radish, etc.

Very rare in this vicinity, but more common northward. Prof. J. B. Smith records it from the Orange Mountains, N. J.

Anthocharis genutia (*Fabr.*).

PLATE II, FIG. 5.

Butterfly.—White, with a large orange patch at the apex of the fore wings, which are marked outwardly with black. At the end of the discal cell is a small black spot. Hind wings white, with a series of small black spots on the outer margin. Underside of fore wings white, slightly tinged with yellow, and the apical area speckled with greenish yellow and the orange shade showing faintly through the wing. Hind wings wholly mottled with greenish patches. The female differs from the male by the absence of the orange patch on the fore wing. Expands about 1½ inches.

Caterpillar.—Body dark yellowish green, glossy, with a yellow longitudinal dorsal stripe and a broader white one along the sides. The upperside is furnished with six rows of shining tuberculate spots and another row along the sides beneath the spiracles. Each spot has a short black hair or process, which tapers slightly and is thickened at the end. Underside paler than above. Head whitish and pale green, with four brownish spots. Length, nearly 1 inch.

Chrysalis.—Slender, abdomen long, rounded, and tapering to a point. Head-case extending into a long cone-like process, so that both ends of the chrysalis look much alike. Sometimes the process on the head is arcuated. Wing-cases prominent, forming a sub-triangulate process with the sides compressed. Color pale yellowish brown, with a reddish tint, mottled with white and darker brown on the thorax ; the process on the head brown. Wing-cases dotted and streaked with black. Body with a dorsal row of black dots, and also a row along the subdorsum. Length, about ¾ inch.

Food-plants.—*Arabis* and *Sisymbrium.*

This pretty species is quite local, and appears to be restricted to certain localities. In this vicinity it has been taken at Nyack and Newburgh, N. Y., also at Delaware Water Gap, Pa., in May. Prof. J. B. Smith records it in his 'Catalogue of Insects found in New Jersey,' from Westville, Mount Holly, Seven Mile Beach and Timber Creek. Single brooded.

Callidryas eubule (*Linn.*).

Butterfly.—Upperside bright lemon yellow, with a zig-zag border of raised scales, of almost the same color, along the outer margin, and a few streaks of the same color along the costa, near the apex. The hind wings have also a narrow margin of raised scales. Underside paler than above, and not so bright, with a ferruginous elongated spot at the end of the discal cell and two silvery spots about the middle of the hind wings; over all the wings are scattered a number of reddish brown patches which are more or less distinct in some individuals. The female differs from the male by having a rather large spot at the end of the cell in the fore wings and a series of brown spots along the outer margin. The hind wings are narrowly margined with orange, otherwise much as in the male. Some specimens have the margins of the wings on the underside narrowly bordered with pink, and the ground color pale orange. Expands $2\frac{1}{2}$ inches.

Caterpillar.—Body pale green, with a bluish tinge, and sparsely covered with minute hairs. Along the sides is a yellow band, and each segment has a transverse row of small black elevated points. Head green. Length, $1\frac{2}{3}$ inches.

Chrysalis.—Pale green with yellowish stripes; sometimes pale yellowish green or roseate and minutely dotted on the back with lighter points. The body is much bent in the middle, and the wing-cases are much protuberant and the head-case very long and horn-like. Length, $1\frac{1}{8}$ inches.

Food-plant.—Cassia.

This species, which is very common in the South, is rarely met with in the vicinity of New York, and only a few occasional specimens have been taken in recent years. In 1870 it was taken in abundance on Fire Island, L. I., and numbers were also seen by the late Hy. Edwards at Long Branch, N. J. It has also been taken in different places on Long Island, Staten Island, Westchester County, and New Jersey. September–October.

Colias philodice (*Godt.*).

PLATE II, FIG. 6.

Butterfly.—Wings sulphur yellow, with the outer margin of both broadly bordered with black, and a black spot at the end of the cell in the fore wings and an orange spot in the hind wings. Underside pale orange, with the hind wing dusted more or less with blackish scales. On both wings there is a row of blackish spots beyond the middle, which are sometimes pinkish on the hind wings, and sometimes wanting entirely. The black spot on the fore wing is the same as the one above; hind wings with a large silvery spot followed by a smaller one of the same color, and both are surrounded with a broad pinkish border. The female differs from the male by having the black border on the fore wings much broader and containing a row of yellow spots. Expands $1\frac{1}{2}$ to 2 inches.

Caterpillar.—Head pale green; body above dark green, paler beneath; on each segment above are four or five transverse creases, with rows of minute whitish tubercles tipped with black on the spaces between. Each tubercle has a short creamy white hair. Along the sides of the body is a rather broad white stripe, through which runs a narrow, broken crimson line. Beneath the white stripe there is sometimes a row of lunate black spots. Length, 1⅕ inches.

Chrysalis.—Yellowish green, with a red line along each side from the wing-cases to the end of the body. Length, 1 inch.

Food-plants.—Clover, Pea, Lupine, etc.

Very common everywhere in this neighborhood. It is found along roadsides, in open fields, gardens, and is especially abundant when the common red clover is in blossom. Sometimes hundreds of these yellow butterflies may be seen in dense masses upon wet spots in the road, swarming when disturbed and settling again when the interruption ceases.

The species varies in size and color from pale sulphur to lemon and bright yellow; also in the breadth of the black borders, and in the degree of dusting of both sides. The color of the underside varies from pale to bright yellow.

In the female a form occurs (albinic var.) which has its ground color pale yellowish white or nearly white instead of yellow. In the male a form occurs (melanic var.) which is thickly covered with black on both sides so as to obscure the ground color. A single specimen of this rare form was taken at Fordham, N. Y. City. The variety *anthyale* Hubner differs from the type form by its small size and narrow black borders.

Colias eurytheme (*Bdv.*).

Butterfly.—Differs from *C. philodice* in having the upperside of the wings orange instead of yellow, and also tinged with orange beneath. Expands 2 to 2½ inches.

Caterpillar.—Similar to *C. philodice*, but has on each side a subdorsal, broken, white and crimson streak, which is absent in *C. philodice*. Length, 1⅛ inches.

Food-plant.—Clover.

A single pair of this species was taken by the late S. L. Elliot at Astoria, Long Island. The specimens are not as deeply orange as the type form. The male is sulphur yellow with a large orange blotch on each of the fore wings, while the female has all the wings quite heavily shaded with orange. The species has also been recorded by Prof. J. B. Smith from Newark, New Jersey. Common in the Western States.

Terias lisa (*Bdv.*).

PLATE II, FIG. 7.

Butterfly.—Bright lemon yellow, with the fore wings bordered with black from the middle of the costa to the hind angle, the border broadest at the apex. Hind wings with a narrow border which is dentate within. Underside wholly yellow, with a few scattered brownish scales on the hind wing and a rather large pinkish-brown spot near the apex. The wings beneath are also narrowly bordered with orange red, which is more or less distinct. The female differs in being somewhat paler, and the black border on the hind wings above being broken. Expands 1 to 1½ inches.

Caterpillar.—Body grass green, with minute hairs and white elevations. Head grass green, with a few white elevations. Length, about ⅔ inch.

Chrysalis.—Transparent green, with a few black dots. Wing-case slightly protuberant ; head case conical. Length, ⅜ inch.

Food-plants.—Clover and *Cassia.*

Occurs in June and again in the latter part of August and early in September. Rather common in sandy places.

Terias nicippi (*Cram.*).

PLATE II, FIG. 8.

Butterfly.—Upperside deep orange, with a black border running from the base of the costa to the hind angle, broadest at the apex, and very narrow along the basal half of the wings along the costa, where the black margin is covered with yellow scales. At the end of the discal cell is a small elongated black spot. Hind wings also with a broad margin running from the apex to the hind angle, with the inner portion irregularly undulated. Underside of fore wings pale orange, with the discal spot broken and the black margin absent. Hind wings bright canary yellow with numerous fine, brown scales scattered over the surface, forming no regular pattern ; about the middle of the wing a few reddish-brown patches and one at the apex. The female varies from lemon yellow to pale orange, with the black border broken at the hind angle of the fore wings, and on the hind wings the black border is more or less broken and washed with yellow scales. Hind wings beneath in some specimens much as those of the male only with the brown patches about the middle of the hind wings more prominent and heavier. Some individuals have the hind wings and the outer part of the fore wings light chocolate brown, with numerous, somewhat darker irrorations and darker patches about the middle of the hind wings. Expands 1¾ to 2 inches.

Caterpillar.—Body pale green along the dorsal surface, whitish green along the sides ; each segment has four or five transverse creases with a number of small tubercles on the ridges, each of which sends out a whitish or black hair. Along the sides is a whitish longitudinal stripe, sometimes containing an orange spot on each segment, or there is an orange line along the whole length. Underside, feet and legs pale green. Length, about 1 inch.

Chrysalis.—Green with raised white corrugations, and sprinkled more or less with brown. Wing-cases very protuberant ; head-case long, conical. Length, ¾ inches.

Food-plants.—Cassia marylandica, Clover, etc.

About 1880 this species appeared in considerable numbers in Central Park, New York City, and other places around New York ; but since then only a few specimens have been taken.

Synopsis of the Species of Pierinæ.

Pieris.

White, with black spot on fore wings (two in the female)........... *P. rapæ.*
Pure white, without markings.................................. *P. oleracea.*
With veins on underside of hind wings heavily bordered with greenish
    scales .... *P. protodice.*

Anthocharis.

Upper wings falcate, tipped with orange in the male............ *A. genutia.*

Callidryas.

Large size. Wings bright lemon yellow........................... *C. eubule.*

Colias.

With silvery spot, in middle of hind wings beneath.
    Wings sulphur yellow, with back borders................... *C. philodice.*
    Wings orange, with black borders.......................... *C. eurytheme.*

Terias.

With no silvery spot in middle of hind wing beneath.
    Wings bright orange, with black borders................... *T. nicippi.*
    Wings lemon yellow, borders black, with ferruginous spot on apex
        of hind wing beneath.................................. *T. lisa.*

NYMPHALIDÆ.

Subfamily NYMPHALINÆ.

Danais archippus (*Fabr.*).

PLATE III, FIG. 1.

Butterfly.—Upperside foxy red or fulvous, with the veins heavily marked with black and the borders black, containing two rows of white spots, and a few lighter fulvous spots in a black field before the apex of the fore wings. Underside paler than above, especially the hind wings, and the white spots are more prominent. Expands 3¼ to 4 inches.

Caterpillar.—Head yellowish, marked with two triangular black stripes. Body above with transverse stripes of black, yellow and white. On the second segment is a pair of long fleshy horns pointing forward, and a similar pair on the eleventh segment pointing backward. Underside black, with greenish between the segments. Length, 1¾ inches.

Chrysalis.—Bright pea green dotted with gold, and a row of golden dots extends more than half way around the body. This band is shaded with black. The chrysalis is suspended by a silken button. Length, 1 inch.

Food-plants.—Different kinds of Milk weeds (*Asclepias*).

Very common in this vicinity, appearing in June and July, but becomes more numerous in August and September, and may be seen until November. Double brooded. In years when conditions have been favorable to the insects' increase, immense swarms of the butterfly may often be seen in autumn migrating southward in streams like birds. According to Dr. S. H. Scudder it leaves its winter quarters in the extreme south with the opening of spring and flies northward, not in flocks or streams, but singly.

Argynnis idalia (*Drury*).

PLATE III, FIG. 2.

Butterfly.—Upperside of fore wings bright orange brown, with the costa and outer margin narrowly bordered with black. Across the cell are three black streaks, and at the end of the cell an irregular round spot enclosing a fulvous spot. Across the middle of the wing is a broken, zig-zag band, beyond which is a row of black spots, and before the outer border is a row of crescent-shaped spots. Hind wings velvety black with a bluish reflection, and the base washed with fulvous; across the middle is a row of cream-colored spots and a row of orange spots near the outer border. Underside of fore wings paler than above, with the black marking repeated. The black crescent-shaped marks before the outer border enclosing a pearly white spot and a few dashes of the same color before the costa near the apex. Hind wings brown, with three rows of silvery white spots across them and four spots at the base. The inner margin and base of costa also silvery white. The female differs from the male by being larger, and the wings broader. The terminal black band of the fore wings is broader and contains a row of white spots. Apex black, with a few white spots. Hind wing with two rows of creamy white spots. Underside similar to the male. Expands 3 to 4 inches.

Caterpillar.—Body velvety black, with a broad ochreous-yellow stripe along the dorsum, enclosing a narrow macular black line, which is sometimes obsolete. Along the sides is a darker stripe; at the junction of segments three transverse bands ending at the one along the sides. The black spaces on each side are crossed by short yellow stripes. Last segment wholly yellow. The body is also furnished with six rows of tapering, fleshy spines; the two rows along the dorsum silvery white, tipped with black. The rows along the sides are smaller and yellowish or orange at base. Head reddish brown on upper half, black below. Underside of body olive brown, with the legs smoky brown. Length, 1¾ inches.

Chrysalis.—Brown, tinged with pink, and marked with black in rather small spots scattered over the thorax and wings and in front of, sometimes including, the tubercles. Length, about 1 inch.

Food-plant.—Various kinds of Violets.

Found during July and August in swampy meadows or adjacent fields, and is common locally. When feeding, the butterfly nervously flutters its wings and darts off at the least disturbance.

Argynnis cybele (*Fabr.*).

PLATE III, FIG. 3.

Butterfly.—Wings orange ochraceous, with the bases black to nearly the middle and covered with orange-ochraceous scales; across the cell are three black bars and an irregular pear-shaped spot at the end of the cell enclosing an orange-ochraceous spot. Across the middle of the wing is a rather broad zigzag band, beyond which is a row of round spots. The outer border of the wing is edged by a narrow black line, preceded by a second, upon which rests a series of black lunules. The two black lines on the outer border are crossed by black dashes, one on each nerve. Hind wings with a transverse band across the middle composed of irregular spots, followed by a row of spots. Outer border similar to that of the fore wing, and preceded by a series of detached crescent-shaped spots. Underside of fore wings much paler than above, with outer margin ochraceous, and a patch of the same color before the apex containing two silvery spots. The lunules near the outer border are brown, and each contains a silver spot; the three nearest the inner angle are black and enclose the ground color. Hind wings cinnamon brown at the base to beyond the middle of the wing, more or less sprinkled with yellow scales, then followed by a broad, conspicuous yellowish space. Outer border cinnamon brown fading more or less into yellow towards the anal angle. At the edge of the dark ground color is a row of silvery spots and a row of the same color before the dark outer margin. At the base of the wing are eleven silvery spots of different sizes. The female differs in having the markings heavier and the basal half of the wings darker. Expands 3 to 3½ inches.

Caterpillar.—Velvety black, with six rows of black spines beset with short black bristles; the bases of the spines are reddish yellow, and the spines on the second segment are wholly black. Between the dorsal tubercles are two transverse gray dots. Underside of body chocolate brown. Head small, subcordate, flattened in front and finely tuberculated, the back much rounded, the vertices subconic, and each on its anterior side giving a small black conic process; the face much covered with black hairs of irregular length; color of front dull dark brown; of back, reddish yellow. Length, 1⅞ inches.

Chrysalis.—Dark brown mottled with drab or reddish brown or almost leaf-brown, more coarsely angulose than *A. aphrodite*, and with more prominent tubercles. Basal segments of body unicolorous. Length, about 1 inch.

Food-plant.—Violets.

Rather common in swampy places. Makes its appearance in the latter part of June, and is found through July and the early part of August. Its habits are much the same as those of *A. idalia*, and it is more abundant. The eggs are laid singly, and they hatch in about fifteen days. The caterpillars go at once into hibernation, and become full fed the following June.

Argynnis aphrodite (*Fabr.*).

Butterfly.—Closely allied to *A. cybele*, but may be separated from that species by its smaller size and by the absence of the dark basal area on the fore wings above in the male, or by its being only slightly indicated; also by the narrow yellow field or band between the outer margin and the brown basal color on the underside of the hind wings. This yellow field is twice as wide in *cybele*, otherwise the markings are much the same only not so heavy. Expands about 2½ inches.

Found in same situations as *A. cybele*, but not so common. June–July. The larva is very similar to that of *cybele*, and also feeds on violets.

Argynnis myrina (*Cram.*).

PLATE IV, FIG. 1.

Butterfly.—Deep orange fulvous with four transverse bars in the cell, more or less united ; about the middle of the wing a transverse zig-zag band, from which runs an irregular dash to the base of the wing ; beyond the zig-zag band is a row of spots. Outer border black, preceded by a series of crescent-shaped spots which are connected with the border, each containing a fulvous spot. Hind wings with the outer border like that of the fore wings ; across the middle is an irregular zig-zag band not reaching the inner border, with another shorter band of the same pattern before it ; near the base of the wing is a round black spot. Underside of fore wings paler than above, with the outer margin and apex ferruginous ; before the outer border, the black crescent-shaped spots from above are repeated, each enclosing a silvery spot. Before the apex is also a silvery patch which is sometimes double. Hind wings ferruginous with yellowish patches, and crossed by three rows of silvery spots ; one row close to the outer border, one a little beyond the middle, and one near the base composed of large spots before which are a few silvery spots, one having a black centre. Expands 1½ inches.

Caterpillar.—Body cinereous brown, mottled with velvety black, there being a large patch at the base of each spine of the two dorsal rows, and is edged with a pale color. The spines are long, tapering and honey-yellow, often orange at the base, with black bristles ; those on the second segment longer than the rest and directed forward. Legs and feet black ; head cordate, bronze, with rounded vertices, with black bristles over the surface. Length, about 1 inch.

Chrysalis.—Dark luteous ; abdomen darker, marked with fuscous ; tubercles of body uniformly conical, those on the third segment between the dorsal and lateral pair very prominent, and those of the first segment smaller than the ones of the second. Length, ½ inch.

Food-plants.—Different kinds of Violets.

This species may be easily known by its small size and silvery spots on the underside of the hind wings. It is common in swampy places and damp meadows, where it usually occurs in abundance. It is on the wing from the latter part of May until early in September, and is probably three brooded. The flight of *A. myrina* is not so rapid as that of *A. cybele* or *A. idalia*. It flies rather slowly amongst tall grass, when not feeding on flowers, and when alarmed will only fly a short distance, and settle again in the grass.

Argynnis bellona (*Fabr.*).

Butterfly.—Differs from *Argynnis myrina* by the absence of the black outer border on all the wings, which are only slightly edged or tipped with black. Inside the outer border is a row of black spots instead of crescents, as in *A. myrina* ; otherwise the markings are very similar. Underside, before the apex of the fore wings, rusty brown tinged with purplish, and the black marking from above not so heavily indicated ; outer row of black spots absent. Hind wings wanting the silvery spots, rusty brown tinged with purplish and yellowish brown nearer the base. Beyond the middle of the wing is a row of indistinct darker spots, and near the base a rather broad, patch-like band, slightly yellowish and scaled with rusty brown. Expands 1½ inches.

Caterpillar.—Head shining, blackish green. Body spined, purplish black, mottled with yellowish and with a velvety-black broken lateral stripe. Spines all of nearly the same size, dull luteous tipped with fulvous. Length, about 1 inch.

Chrysalis.—Yellowish brown with dark yellowish-brown creases ; the tubercles on the first and second segments of equal size ; those on the third segment, between the dorsal and lateral pairs, very prominent. Length, about ½ inch.

Food-plants.—Different species of Violets.

Common in this neighborhood, and is found together with *Argynnis myrina*, but is not so abundant. June to September.

Euptoieta claudia (*Cram.*).

PLATE III, FIG. 4.

Butterfly.—Upperside fulvous with two zig-zag bands across the fore wings, with the color between a little paler, the inner band being heavier and blacker. At the end of the cell is an oval black circle, and in the middle of the cell a short bar and another one beneath it ; beyond the outer zig-zag line is a row of rather large black spots, followed by a narrow transverse line a little before the outer border, which is also black. Hind wings with the marking much the same as on the fore wings. Underside of fore wings paler than above, with paler space between the two zig-zag bands also lighter, the outer zig-zag band and the black outer border absent, and the narrow band before more or less indicated. Before the apex on the costa is an ashen gray triangular mark ; apex brownish. Hind wings with basal half brown, beyond which is a broad light brownish band-like shade, finely speckled with darker scales ; at the costa this band is paler. This band is followed by a broad brown shade nearly the same as the color at the base of the wing, and is edged off by a terminal pale line. The veins are light grayish, and the round spots from above are faintly reproduced with a small light centre. The female differs by being somewhat deeper in color with the black marking heavier. The markings beneath are also more distinct. Expands 2 to 2½ inches.

Caterpillar.—Orange ochre, smooth, striped longitudinally with black, which is almost concealed by the white spots which cover it. Two stripes are on the subdorsum and one on each side above the spiracles; beneath the spiracles, at the base of the legs, is a maculate white stripe. On back of each segment from the third to the twelfth is a small, elongated white spot, edged with black. On the body are six rows of spines; two subdorsal standing on the black stripes and running from the first to the twelfth segment; one on each lateral stripe and running from the fourth to the twelfth segment, in line with these is a spine placed between the first and second segment and one between the second and third. The other rows are beneath the spiracles. The dorsal spines on the first segment are orange at the base, as are also those between the anterior segments, but all the rest rise from lustrous blue-black conical tubercles, and all spines are blue-black, slender, a little thickened at top and beset, thickly, with fine short black bristles. The spines are of nearly uniform length, except the two dorsal ones on the first segment, which are slender and enlarged into an ovate club at the tip; they are directed forward over the top of the head. Between this pair of spines is a black patch, and on the edge of the segment a white spot. Underside blackish brown. Head small, subcordate, flattened in front; surface lustrous, brown black, with orange patches. Length, about 1½ inches.

Chrysalis.—Pearly, with the surface giving all the colors of the rainbow, while the tubercles are golden and the spots here and there orange. Length, ⅞ inch.

Food-plants.—Violets, Mandrake, Passion-flower, *Sedum*, *Portulacca* and *Desmodium*.

Not common in this vicinity, and usually found in damp, open places where species of *Argynnis* occur. There are probably two broods here, one in June and July, and the other in August and September.

Melitæa phaëton (*Drury*).

PLATE IV, FIG. 2.

Butterfly.—Upperside black with two or three rows of yellowish-white spots beyond the middle of the fore wings and a row of larger brick-red spots along the outer borders, and two patches of the same color in the cell. Hind wings also black with two rows of yellowish-white spots before the row of brick-red spots along the outer border and two patches of brick-red near the base of the wing. Underside with the yellowish-white and brick-red spots repeated and more distinct ; and a few additional yellowish spots at the basal part of the fore wings. On the hind wings there are four rows of yellowish-white spots, the outer one being crescent-shaped like those on the upper side. Before the middle of the wing is a broad patch-like brick-red band, and a few spots of the same color and a few smaller yellowish-white ones before it, near the base of the wing. Expands about 2 inches.

Caterpillar.—First, second and part of the fourth segment and the last two segments black ; the remaining segments deep fulvous red, with narrow black transverse bands : one band running with the spines, one on the junction of the segments, and one before this last. On the dorsum and sides are seven rows of long, fleshy, black spines, each arising from a round, shining blue-black tubercle ; each spine is provided with a number of bristling black hairs ; beneath the spiracles is another row of smaller spines. Underside orange, with a black ventral stripe. On the fourth and fifth segments is a small black tubercle, with short spines, and between the pairs of legs are several minute tubercles with short hairs ; legs black ; head black, bilobed, tuberculated, and with short black hairs. Length, 1⅓ inches.

Chrysalis.—Varying from pearly to pure white, spotted and marked with brownish black, with the tubercles on the abdomen and thorax orange, each marked anteriorly by a black crescent. On the lower side is a black stripe, running from anal extremity to the head, on top of which it is bifurcated. Across the wing-cases is an irregular band edged with orange, and at the hind-borders are brown serrations. Length, ⅘ inch.

Food-plants.—Chelone glabra, *Viburnum dentatum*, *Lonicera ciliata*, *Gerardia*, etc.

This species is single brooded, and is not rare in this vicinity, but is very local in swampy places. It is found on the wing about the middle of June. In flight the butterfly is slow and sluggish, alights on the leaves, shrubs, grasses and on the ground. The eggs are laid in masses, and the young larvæ spin a web in which they live in colonies until the following spring; after the larvæ become older they leave the web and live singly on the leaves.

Phyciodes tharos (*Drury*).

PLATE IV, FIG. 3.

Butterfly : Winter form, **marcia** *Edw.*—Upperside reddish fulvous, marked and bordered with black. Outer margin broadly bordered with black, through which runs a narrow wavy line or a series of small crescent-shaped fulvous spots, the one about the middle being quite large, while the others are often obsolete. Costa and inner margin narrowly bordered with black. Near the base of the wings is a band composed of small black circles which are more or less confluent. Base of wings blackish, with traces of a few black circles. At the end of the cell is an oblong black circle, and at middle of the wing, on the costa, is a large oblique subtriangular patch and one on the inner margin; these patches are connected with a narrow dentate line. Then comes a broad fulvous band followed by a narrow dentate or wavy line, after which is a series of fulvous spots which are immediately before the black outer border. Hind wings with basal portion much like the fore wings; beyond the middle there is a narrow wavy line followed by a series of black spots; then comes the broad black outer border in which is a row of more or less distinct, pale yellowish crescents. Underside pale fulvous, marked with yellowish patches, often near the outer border, before which is a crenated narrow line; parts of the black marking from above are repeated. Hind wings with grayish-white, ochreous and brown patches; a double line near the outer border, forming irregular crescent-shaped spots, of which the middle one is white and conspicuous; before these markings is a row of small black dots, and at the basal half the markings are similar to those above, but composed of brown lines. The female is much like the male. Expands 1 to 1½ inches.

This form varies considerably, especially in the underside of the hind wings, being more or less washed with brown, yellowish or grayish white, and the markings also more or less distinct. Sometimes the white crescent-shaped spots are obscured with rusty brown. It is almost impossible to give an accurate description of this species which would apply to it as a whole. It, however, is so common that any one finding it cannot fail to recognize it.

Summer form, **morpheus** *Edw.*—Same size as *marcia*, with the upperside much the same. The underside of the hind wings are yellow with the narrow transverse marking brown or only faintly indicated, and the outer border brown concealing the crescents; at the angles the crescents are the same as the ground color, and only in some individuals the middle crescent is whitish. There is also as much variation in this form as in *marcia*.

Caterpillar.—Dark brown dotted with yellow and striped with yellow and black, the yellow always dull; armed with seven rows of spines, one dorsal and three on either side, besides smaller and similar spines at base of body, one on each segment from the third and over the pro-legs two on each. The spines are stout, tapering, dark brown, partly white-tipped; those of the upper and lower lateral rows more or less orange-tinted at base, each beset with many straight black bristles. Head cordate, either black or bronze, shining; on each vertex a cordate yellow spot, and on each side a sickle-shaped stripe. Length, ¾ inch.

Chrysalis.—Grayish white with darker creases, darker on the body, which has a dull band below the spiracles. Length, [illegible] inch.

Food-plants.—Various kinds of Asters.

Very common from May to the latter part of September and early in October. It is found in open meadows and fields, and is probably three brooded in this vicinity. The form *marcia* appears in May and June, and produces the form *morpheus*.

Phyciodes nycteis (*Doubl.*).

PLATE IV, FIG. 4.

Butterfly.—Upperside fulvous, with a broad black terminal border, broadest at the apex, and enclosing a row of fulvous spots which in some specimens are obsolete or wanting. About the middle of the wing is a long, irregular black patch which is connected by a narrow line with another patch on the inner border. At the base of the wing is a number of black circles more or less coalescing. Hind wings with the basal half similarly marked as the fore wings ; across the middle is a narrow black band, followed by a row of black spots ; outer border black. The fringes of all the wings are black with whitish patches. Underside of upper wings paler than above, with the black patch from above on the costa at the middle of the wing faintly repeated. The broad black terminal border is also faintly repeated, but is much broken by the fulvous ground color, and enclosing a few black spots. Before the fringes is a narrow fulvous border. At the apex are three connected silvery-white spots, and one or two near the middle before the fulvous outer border. Hind wings yellowish and dark brown. Near the base is a broad silvery-white band and a similarly colored band across the middle of the wing, broken by the brown veins. Between these two bands are a number of brown, wavy lines. Outer border with a terminal fulvous line like that on the fore wing, and on which rests a row of silvery white lunules, the two at the apex and the middle one being larger than the rest ; before these lunules is a row of black spots. Expands $1\frac{1}{2}$ to $1\frac{3}{4}$ inches.

Caterpillar.—Blackish brown above, with seven rows of long black spines, one dorsal and three lateral rows on each side, all arising from shining black tubercles, except lower lateral row which has yellowish tubercles, and each with bristling black spines. At the base of the body is a dull green stripe, with a yellow stripe in line with the lower lateral spines and a broken yellow line running with the spiracles. Sometimes this line is ochre or reddish yellow ; the basal line is dotted with yellow. Underside greenish brown spotted with yellow. Head cordate, shining black, with black hairs. Length, 1 inch.

Chrysalis.—Similar in shape to that of *Melitæa phaeton*, with five rows of tubercles on the abdomen. It varies much in color ; some are greenish yellow, others pink brown, others gray brown, with a few dark markings. Length, $\frac{3}{4}$ inch.

***Food-plants.*—Asters, Sunflower and *Actinomeris*.**

Quite rare in this vicinity. In general appearance it very much resembles *Phyciodes tharos*, especially in color and in the marking on the upperside; but the underside of the hind wings is very different, being provided with silvery white bands and lunules which are absent in *P. tharos*. It is also a larger insect. June–July.

Phyciodes harrisii *Scud.*

Butterfly—Upperside very similar to *P. nycteis*. Underside with the outer border orange fulvous preceded by a row of whitish lunules and a row of spots of the same color. The lunules are in a narrow blackish-brown field, which is broadest before the apex; before the middle of the wing a few narrow black streaks. Hind wings with five large yellowish-white spots with narrow black borders in an orange field at the base. Across the middle of the wing is a band of large yellowish-white spots also narrowly bordered with black; then comes a brownish-black space in which is a row of black spots with a whitish pupil, and are surrounded with orange. The terminal border is orange, preceded by a series of rather large white lunules. Expands 1½ to 1¾ inches.

Caterpillar.—Body deep reddish fulvous with transverse black stripes, one before and two after each transverse row of spines, and a longitudinal black dorsal stripe; last two segments black; on the ninth to eleventh segments the fulvous bands are broken. The seven rows of spines stand on a broad black band, each spine with long hairs and arising from shining black base. Head black, granulated, and covered with short black hairs. Legs black. Length, 1 inch.

Chrysalis.—Pure white, marked and spotted with blackish and orange, last segment black; a broad black band on the ventral side reaching from the head-case to the lower end of the wing-cases. The abdomen has an orange band between each segment; on the abdomen are several rows of orange tubercles, and nearly all have a black crescent on the anterior side. On the wing-cases is a curved black longitudinal band, and the nervules of the wings are orange. Length, about ⅔ inch.

Food-plants.—Asters and *Diplopappus*.

Very rare in the vicinity of New York City. Single brooded. June.

Grapta interrogationis (*Fabr.*).

Butterfly: Form **umbrosa** *Lint.*—Upperside fulvous with two round spots in the cell and at the end an oblong patch of the same color; a row of four round spots running from the inner margin to the end of the cell. Outer border ferruginous with a subapical patch on the costa and one on the inner margin ; both these bars run together at the middle and appear to form part of the outer border. Hind wings blackish brown, with a short tail and a few black spots which are only dimly visible owing to the dark ground color ; base of wing ferruginous. Edges of both wings bluish gray. Underside much variegated with patches and spots of different shades of brown, olivaceous and more or less purplish. Across the middle of the wing is a narrow angulated band, beyond which is a row of minute black dots. Hind wings similarly marked, with the band wavy. In the middle is a silver C which is broken at the lower end. Expands 2 to 3 inches.

Form **fabricii** *Edw.*—Differs from the form *umbrosa* in having the fore wings more falcated, the tail on the hind wings longer and narrower, and the anal angle much produced. The fore wings above with the markings like *umbrosa*, but the ground color and outer border of a lighter shade. The hind wings are ferruginous instead of brownish black as in *umbrosa*, and have a row of fulvous spots before the outer border, and the black spots distinctly visible. The margins of both wings are bordered with lavender. Underside clouded in shades of brown and ferruginous, sometimes partly suffused by purplish. General pattern as in *umbrosa*, but without the striking diversity of color. In some specimens the brown color is quite evenly distributed over the wings. Size same as in *umbrosa*.

Caterpillar.—Color dull black, with white, yellow and red tubercles, and longitudinal lines and bands of red and yellow, varying greatly in distinctness. Some larvæ are black, finely specked with yellow without longitudinal lines on the upperside ; others have small spots in place of specks, and have more or less distinct longitudinal lines of either yellow or red or mixed ; others have the body russet brown, with many yellow spots, with the lines often obsolete. There are also intermediate variations. The seven rows of spines also vary in color from deep red to yellow or mixed. Length, 1½ inches.

Chrysalis.—Yellowish brown to dark brown in color, with a large, compressed, blunt beak-like process on the thorax and three rows of tubercles on the abdomen, on which are eight silvery spots. Length, 1 inch.

Food-plants.—Elm, Hackberry (*Celtis*), Hop, Nettle and Basswood.

Rather common during the warmer weather, but rather difficult to capture, as are also the other species of *Grapta*. In this vicinity there are probably three broods, the last one hibernating in the butterfly state.

Grapta comma (*Harris*).

PLATE IV, FIG. 6.

Butterfly.—This, like the preceding, is a dimorphic species, the winter form being known as *harrisii* Edw., which over-winters, and the summer form as *dryas* Edw. The color and markings much the same as in *Grapta interrogationis*, but instead of four black spots running from near the inner margin to the end of the cell there are only three. It also differs in having the wings more scolloped and regularly falcated in both forms, and the tails on the hind wings broader and shorter than in *interrogationis;* otherwise the marking above are similar. The form *harrisii* has the hind wings above ferruginous, and the form *dryas* has the hind wing dark brownish black with a subterminal row of fulvous spots which are more distinct in the form *harrisii*. The underside of both forms is distinctly marked by different shades of brown and washed with pinkish and olivaceous. The angulated band seen in *interrogationis* is also present. In the middle of the hind wing, on the angle of the band, is a distinct silvery-white open C, or comma. Some examples have the underside almost uniformly brown with faint, short streaks of a darker shade. It is also smaller than *interrogationis*. Expands 1½ to 2¼ inches.

Caterpillar.—Very variable in color. The body in some is black with yellow spots, and spines tipped with black; others are cream white or greenish white, with almost no markings; others are velvety black with yellow bars and bands across the dorsum and a yellow band along the sides; in others again the body color is brown. In light examples the head is dull pink, in the dark ones black, sometimes with a forked white stripe down the front and covered with spines. Length, 1¼ inches.

Chrysalis.—Same in shape and color as *G. interrogationis*, with golden protuberances on the abdomen. Length, ⅘ inch.

Food-plants.—Elm, Hop, Nettle, *Celtis* and Basswood.

Not quite so common as *G. interrogationis*, and probably is three brooded in this vicinity; the butterflies of the last brood over-winter.

Grapta progne (*Cramer*).

Butterfly.—Upperside of both wings same as in *Grapta comma*. Underside grayish brown, closely streaked with fine, short lines. Beyond the dark portion on the fore wings the color is pale ashen gray, washed with pinkish, somewhat lighter towards the apex. This light color is also streaked with brown. Before the outer border of both wings is a narrow greenish-blue wavy line. In the middle of the hind wings is a white open L, which in some specimens is only faintly indicated. Expands 1¾ to 2 inches.

Caterpillar.—Color, buff; the cross stripes on the posterior parts of segments black and pale buff; in front of each dorsal spine is a V-shaped reddish bar, which passes round the spine, and there is an oblique bar of the same color in front of each of the first laterals, and from its base directed forward and downward ; the second laterals stand on a straight or slightly arched bar of the same color. The spines on the third, fourth and fifth segments larger than elsewhere ; the dorsals white, reddish or honey yellow at bottom, and from yellow tubercles ; the first laterals white from fourth to eleventh segments, but on third, fourth and twelfth segments are black with buff branches ; the second laterals are all black, yellow at base and stand on yellow tubercles ; the lower laterals all white, on yellow tubercles. The color of spines on second segment is yellow ; spiracles black in yellow ovals ; feet black, prolegs yellow and brown. Head subcordate ; on each vertex a large compound spinous process, the main stem black, the branches partly black and yellow ; the face and sides thickly covered with simple conical spines of irregular sizes, buff or yellow ; the sides and frontal triangle black, the rest yellow. Length, 1⅓ inches.

Chrysalis.—Like that of *G. comma* in shape. Color dull green, brown and pinkish white.

Food-plants.—Wild and cultivated Currant and Gooseberry.

Less common than *G. interrogationis* and *G. comma.* It is double brooded, the first brood of butterflies appearing in early summer and the last in August, which over-winters.

Grapta faunus *Edwards.*

Butterfly.—May be easily recognized by the deeply incised and notched outer margins of both wings. The pattern and color are about the same as in *G. comma ;* it is deeper colored than its allies, and the black markings are more prominent, making it a rather conspicuous species. The underside is beautifully marbled with various shades of brown, from light to dark brown, and mottled with gray white, and streaked with black lines, especially beyond the angulated band across the middle of the wings. In this light shade is a row of olive green spots, followed by a wavy line of the same color before the outer borders. The green spots and line are larger on the hind wings, which have a silvery white C-shaped mark in the middle, varying in form. Expands about 2¼ inches.

Caterpillar.—Body brownish yellowish with white spines and a large white patch on the dorsum on the posterior half of the body. Head black, with a light W-shaped mark on the front and a number of black spines. Length, 1⅛ inches.

Chrysalis.—Pale brown streaked with green, with the ocellar tubercles equal on basal half, conical beyond, the notch between them deeper than broad. Tubercles on body not much larger than the others. Length, about 1 inch.

Food-plants.—Birch (*Betula lenta*), Willow, Wild and Cultivated Gooseberry.

Very rare in this vicinity, and only a few examples have ever been taken. It is a mountain insect, common in the Catskill Mountains and northward.

Grapta j-album (*Bd.-Lec.*).

Butterfly.—Upper wings dull yellowish washed with rusty brown ; basal half ferruginous. In the cell is a large black spot, and on the costa at the end of the cell a larger patch, beyond which is another costal patch, connected by a white subapical spot with the black border, which is before the outer yellowish and black margin. Beneath the cell between the veins are four large black spots. Hind wings ferruginous, with a broad dull yellow outer border through which runs a ferruginous or blackish band ; on the costa about the middle is a large black spot, to which is connected a white spot. Underside of wings with basal half brownish, with light and dark wavy lines ; then grayish white smeared with light brown, in which is a row of minute black spots ; before the outer margin is a narrow wavy greenish band, followed by a violet-brown shade. Expands 3 inches.

Caterpillar—Body light green with seven rows of spines, with long bristles. The three upper rows of spines are black and the others reddish. Sometimes the larva is black with white spots, and the underside greenish. Length, 2 inches.

Chrysalis.—Pale green or flesh-color, sometimes tinged with reddish, with two rows of tubercles, eight in each row, of which six are bright, shining silver. Length, about 1¼ inches.

Food-plant.—Paper Birch (*Betula papyrifera*).

This species is very rare, and only a few examples have been captured in the vicinity of New York. It is recorded from Newark and Caldwell, N. J., Staten Island, Central Park, New York City, and different places on Long Island. May, August and October. In the Northern States the butterfly is quite plentiful.

Vanessa antiopa (*Linn.*).

Butterfly.—Uppersides of both wings rich velvety brown with a broad yellow outer border, speckled with black ; before the yellow border is a row of blue spots. On the costa of the fore wings are two yellow spots beyond the middle. Underside deep brownish, with numerous black transverse lines. Outer borders dirty white, sprinkled with brown. In the aberrant form *hygiæa* Hey. the yellow outer borders are about twice as wide and the blue spots are absent. Expands 2½ to 3 inches.

Caterpillar.—Body black, covered with numerous small white dots; along the back is a row of large red spots, and seven rows of rather long, sharp spines, the dorsal row being shorter. Length, 2 inches.

Chrysalis.—Grayish brown with a pointed prominence on the thorax and two rows of short spines along the back of the body and two on the head-case. Length, 1 inch.

Food-plants.—Elm, Willow, Poplar and Hackberry (*Celtis*).

This species over-winters in the butterfly state in sheltered places. It may be found under stones, stumps of trees, or sticking to the rafters of a barn and in crevices of walls, huddled together sometimes in numbers, with the wings doubled together above the back and apparently lifeless. During the first warm days of April and May it crawls forth from its winter quarters, and hovers in numbers about sappy stumps of recently felled trees. About the middle of July the butterfly becomes scarce until the advent of the second brood in August. The female deposits her eggs in a cluster around the twig near the petiole of a leaf. The caterpillar is gregarious in habits, living together in companies. The first brood of caterpillars appears in June and the second in August.

Vanessa milberti (*Godt.*).

PLATE IV, FIG. 5.

Butterfly.—Upperside blackish brown, with a broad fulvous band across both wings beyond the middle; outer edge blackish brown with a row of blue spots on the hind wings. In the cell and the fore wings are two fulvous spots and a blackish one on the costa in the fulvous band followed by a small white spot. Underside blackish brown with the band from above chocolate brown, and a number of black and brown transverse lines. Expands 2¼ inches.

Caterpillar.—Black covered with numerous yellow and white points, each with a short white hair; along the sides, in line with the lower lateral spines, is a bright yellow stripe and another similar stripe above the spiracles. Between these stripes is an orange shade. Sometimes these lines are broken and reduced to patches. The spines are arranged as in *Vanessa antiopa*. The lower spines are yellowish and the others black. Head black, shining, with white and black tubercles sprinkled with white. Length, about 1 inch.

Chrysalis.—Same shape as in *V. antiopa* but smaller. Color variable; some are dull whitish with brownish stripes on the body; some are wholly light brown and bronzed, and others are dark brown. Length, ¾ inch.

Food-plant.—Nettle.

Taken at West Farms, New York City, Orange Mountains, N. J., Staten Island and Long Island. Very rare in June, September and October. More common throughout the Northern States, Canada, and westward to the Pacific. The eggs are laid in masses usually on the underside of the leaves, and the caterpillars live in swarms.

Pyrameis atalanta (*Linn.*).

Butterfly.—Upperside of fore wings with the basal half velvety brown and an oblique, broad, bright red band running from the costa before the middle to nearly the hind angle ; above this band the wing is black with six white spots, the inner one being an oblique dash on the costa. Hind wings velvety brown with a broad red band on the outer edge, in which is a row of small black spots. Underside of fore wings with the red band repeated but lighter, followed by an irregular blue ring near the costa. The white spots are also repeated ; apex light brown tipped with lilac. Hind wings marbled with brown, with darker brown indistinct spots and wavy transverse lines ; a whitish patch on the middle of the costa, and a row of round, indistinct, submarginal eye-like spots, the centre of some being olive green. Expands 2 to 2½ inches.

Caterpillar.—Black with seven rows of branching black spines, which are sometimes yellow ; along the sides is a variable broken band composed of yellow patches. The body is also covered with fine yellow points. Underside smoky brown. Head black, with short spines. Length, 1⅓ inches.

Chrysalis.—Blackish gray with a delicate bloom, and the dorsal tubercles more or less gilded. Sometimes it is greenish gray with a bronzy shade over the dorsal area. In shape it is much like that of *V. milberti.* Length, 1 inch.

Food-plants.—False Nettle (*Bœhmeria*) and Hop.

Common from the latter part of May until November, and is double brooded. The caterpillar draws together the edges of the leaf and forms a commodious cavity which shelters the larva within. The butterfly is usually found along wood paths or open woods and fields. It occurs all over North America and also Europe.

Pyrameis huntera (*Fabr.*).

Butterfly.—Upperside fulvous ; apical portion of the fore wing black, which is continued as a border to the hind angle. In the black field at the apex are four white spots, and a fulvous patch on the costa beyond the middle of the wing. In the cell are two black marks, also one at the end and one beneath the cell, and a black band running from the end of the cell to inner border before the hind angle. Hind wing fulvous with a black outer border, containing a narrow, wavy fulvous line ; before this is a row of black spots, two having blue centres. Underside of fore wings salmon red, with the black marking from above partly repeated. Apical area gray brown, with broken eye-like spots, and the fulvous mark from above white ; extreme tip of apex lilac. Hind wings with a delicate whitish net-work at basal portion in brown field. Across the middle is a broad whitish band, sprinkled with brown, and the veins whitish ; beyond this is a brown field containing two large eye-like spots with opalescent pupils. Outer border grayish with four narrow black lines. The space between the inner two lilac. Expands 2 to 2½ inches.

Caterpillar.—Blackish, with four pale yellow transverse lines between the joints. Beneath the spiracles are two yellow lines, the lower interrupted, both spotted with black. The seven rows of spines are yellow or brown. Length, 1¼ inches.

Chrysalis.—Yellowish with brown or olivaceous markings, sometimes golden green marked with purple and darker markings ; an obtuse angle on the thorax, and two rows of spines on the body. Head-case projecting, bifid. Length, ¾ inch.

Food-plants.—*Gnaphalium* and *Artemisia.*

Common in open fields and roadsides. The larva draws the leaves together and forms a rude case, within which it lives. Double brooded. May to October.

Pyrameis cardui (*Linn.*).

PLATE IV, FIG. 7.

Butterfly.—Very similar to the preceding species, but may be distinguished by the white patch in the black apical area, instead of a fulvous patch as in *P. huntera.* The fore wings are also less concave on the outer border beneath the apex, and are also somewhat more angular. The underside of the hind wing is marbled with light brown and white, with the veins forming a delicate net-work ; before the outer margin is a row of four eye-like spots, which are much smaller than the two in *P. huntera.* Expands 2 to 2¾ inches.

Caterpillar.—Body varying from grayish to brownish ; with a yellow, broken dorsal stripe and one along each side beneath the spiracles. The spines are yellow and placed like those of *P. huntera.* Over the body are also numerous minute yellow dots, from which proceed fine whitish hairs. Head blackish, covered with fine whitish hairs. Length, 1½ inches.

Food-plants.—Various kinds of Thistles, Burdock, Sunflower, Hollyhock, etc.

Common in this neighborhood, and may be seen flying in company with *P. huntera*. Double brooded. The larva lives singly within a few leaves spun together with silken threads. The chrysalis is similar to that of *P. huntera*. It is a cosmopolitan species.

Junonia cœnia (*Hübner*).

PLATE IV, FIG. 8.

Butterfly.—Upperside of fore wings sepia brown, with an oblique dirty whitish band beyond the middle, and enclosing a large black eye-like spot with a blue centre, and above it a small spot which is sometimes absent. In the cell are two deep orange-fulvous bars, and outside the large spot also orange. Hind wings same in color as the fore wings, with two eye-like spots followed by a subterminal, orange-fulvous border. Underside very variable, from a light brown to a reddish brown; these colors being confined to the apex of the fore wings and hind wings, which have a few narrow, wavy transverse lines. The two eye-like spots on the fore wings are repeated, and the two bars in the cell are orange; on the hind wings are two or three small eye-like spots. Expands 1¾ to 2½ inches.

Caterpillar.—Black with fine white specks sprinkled over the dorsum, and a yellow band on each side, one along and one beneath the spiracles. Spines similar to those of *P. cardui*, black. The two stigmatal rows on each side yellowish. Head black, sprinkled with white and an orange triangle in the middle of the face. Length, 1½ inches.

Food-plants.—Gerardia, Plantain and Snap-Dragon.

Common from May to November, and is double brooded. It may often be seen flying on dusty roads, and may be easily recognized by the four eye-like spots on the upperside of the wings. The chrysalis is similar to that of *P. cardui* and *huntera*.

Limenitis disippus (*Godt.*).

PLATE III, FIG. 5.

Butterfly.—Upperside of fore wing reddish fulvous, the veins heavily marked with black; costa, also inner and outer borders, black, the latter broader and containing a row of white spots; on the costa beyond the middle is a triangular patch connected with the outer border beneath the middle, and contains three white spots. Hind wings also reddish fulvous, veins black, and a transverse, narrow black band across the middle; outer border black with a row of white spots. Underside much paler than above with the black markings the same ; outer borders with two rows of white spots ; hind wing sometimes with a row of white spots before the transverse black line. Expands 2½ to 3 inches.

Caterpillar.—Head olive green with numerous short tubercles, and a pair of short, blunt processes on the vertices. Second segment with two long horn-like processes with short conic tubercles. Along the sides is a rather broad whitish stripe, above which the body is mottled with different shades of olive green. First, second and eighth segments whitish, the first two speckled with brown ; on the third and fifth segments are two swollen humps on each ; those on the fourth segment more prominent. On each of the ninth and tenth segments are two short bunches of tubercles, and four on the twelfth segment. Length, 1⅜ inches.

Chrysalis —Grayish brown, shining, and marked with brown, flesh-color and silvery white. On the middle of the back is a prominent rounded appendage. Length, about 1⅛ inches.

Food-plants.—Willow, Poplar, Apple, Plum and Oak.

The butterfly in general appearance resembles *Danais archippus*, but may be at once distinguished by its small size, scolloped outer borders, and the black band across the middle of the hind wings. It is common in this vicinity, and Willow seems to be the most favorite food of the caterpillar. The butterfly is usually found along the borders of damp places and in waste fields. It is double brooded, the first brood appearing in June and the second in July and August. The young caterpillar of the last brood rolls a leaf together, in which it remains over winter and completes its transformations the following spring.

Limenitis astyanax (*Fabr.*).

Butterfly.—Fore wings black with a bluish or greenish reflection. Along the outer border are two rows of blue spots, preceded by a row of orange spots, which are more or less distinct. Hind wings with the bluish reflection stronger and forming a metallic band of spots beyond the middle of the wing ; outer border with two rows of metallic blue spots larger than those on the fore wings. Underside brownish, partly tinged with bluish, with the blue and orange spots on the outer border of the fore wings repeated. In the cell are two orange patches. Hind wing with three orange spots at the base and a row of the same color followed by two rows of blue spots along the outer border. The male and female are similarly marked and colored. Expands 2½ to 3 inches.

The larva and chrysalis are similar to those of *D. disippus.* The larva feeds on Willow, Wild-gooseberry, Cherry, Apple, Plum, Thorn, Huckleberry, etc. The butterfly is double brooded, the first brood appearing in May and June and the second in July and August. The butterfly frequents orchards and feeds on fallen fruit.

Synopsis of the Species of Nymphalinæ.

Danais.

Reddish brown, with black veins and borders	*D. archippus.*

Argynnis.

Large species.	
Upper side of hind wings black, with a bluish reflection and two rows of spots	*A. idalia.*
Underside of hind wings with a broad yellowish band	*A. cybele.*
Underside of hind wings with a narrow yellowish band	*A. aphrodite.*
Small species.	
With silver spots on underside of hind wings	*A. myrina.*
Rusty brown on underside of hind wings and without silver spots,	*A. bellona.*

Euptoieta.

Upperside fulvous, with black markings; hind wings beneath with brown and ashen-gray shades	*E. claudia.*

Melitæa.

Black, with rows of pale yellow spots, and a row of brick-red spots along the outer borders	*M. phaëton.*

Phyciodes.

Upper surface fulvous, with black markings.	
Underside of hind wings with silvery white bands	*P. nycteis.*
Underside of hind wings with yellowish white bands	*P. harrisii.*
Underside of hind wings with grayish, brown and ochraceous blotches (form *marcia*), or entirely ochraceous with a brown outer patch (form *morpheus*), and with transverse brown lines	*P. tharos.*

Grapta.

Wings falcate.	
Hind wings beneath with a broken C	*G. interrogationis.*
Hind wings beneath with C not broken	*G. comma.*
Underside streaked with black lines	*G. progne.*
Underside marked with olive green on the outer parts	*G. faunus.*
Hind wings above with a large white spot on the costa	*G. j-album.*

Vanessa.

Wings velvety brown, with yellow borders	*V. antiopa.*
Smaller in size, with a broad fulvous transverse band on each wing.	*V. milberti.*

Pyrameis.

Wings velvety brown, with an oblique red band................*P. atalanta.*
Wings fulvous with black markings.
  With two large eye-like spots on underside of hind wings.... *P. huntera.*
  With five small eye-like spots " " " ......*P. cardui.*

Junonia.

Wings sepia brown, with large eye-like spots above ....*J. cœnia.*

Limenitis.

Reddish brown with black borders and veins, and a transverse band across the middle of the hind wings.......................*L. disippus.*
Velvety black, with metallic blue shades and spots...............*L. astyanax.*

Subfamily SATYRINÆ.

Neonympha eurytris (*Fabr.*).

Plate V, Fig. 1.

Butterfly.—Upperside of both wings wood-brown, with two black eye-like spots with yellow rings on the fore wings near the outer border, and two eye-like spots on the hind wings, one large and one small spot near the anal angle. In the female there is only one spot on the hind wings. Underside very much paler than above, with two narrow transverse lines on both wings, with the spots on the fore wings repeated. Hind wings with four eye-like spots, two near the apex and two near the anal angle; between these are two small silvery spots. Expands 1⅛ to 1¾ inches.

Caterpillar.—Body flat at base, the dorsum rounded, much arched on middle of segments, the sides flat and sloping; over the feet a fleshy ridge; the second segment constricted, much as in the larvæ of *Hesperia*; the last segment bifurcate, each fork short, pointed, divergent. Color of dorsum yellow brown; of sides, darker; a mediodorsal band dark brown, and on either side of this, on each segment from the fourth to the eleventh, is an indistinct patch; the lateral area separated from the dorsal by two wavy parallel lines, the upper one dark, the other yellowish. On the side of each segment, from the fifth to the eleventh, is a dark oblique stripe; the basal ridge yellowish, the tails tipped with red; the whole surface covered with sharp tubercles of irregular sizes, and colored as the ground, each emitting a very short brown hair; feet and legs yellow-brown; head subpyriform, flattened in front, truncated at summit and slightly depressed. The vertices a little produced, pointed and compressed. Color yellow brown, finely tuberculated; the face crossed by three rows of rounded brown patches. Length, 1 inch.

Chrysalis.—Cylindrical ; body stout, and larger than the anterior portion ; thorax rounded ; head-case truncated. Color pale yellow brown, the wing-cases and interior parts streaked with fine, abbreviated, brown lines ; body beneath with two brown stripes, and on the middle of each side a row of brown points. Length, ½ inch.

Food-plants.—Various species of Grasses.

Common from the latter part of May until August, in woods and in fields near by, especially if these last are more or less overgrown with shrubs. Single brooded.

Neonympha canthus (*Linn.*).

Butterfly.—Paler brown than the preceding species, with a row of black spots in a lighter field before the outer border of the fore wing. Hind wings with five larger, black, eye-like spots before the outer border ; the three lower spots are in pale yellow rings. Underside much paler than above, with two narrow, wavy transverse lines ; the black eye-like spots from above are repeated ; those on the fore wings are surrounded with a yellow circle, and enclosed in a whitish ring. The six spots on the hind wings are quite conspicuous, and are in rings of yellow, brown and white. All the spots have a white dot in the centre. Expands 1¾ to 2 inches.

Caterpillar.—Slender, tapering into two long tails on the last segment, with rough tubercles ; each segment is creased transversely. The whole surface is covered with fine tubercles, each with a fine, very short hair. Body green, with narrow yellow longitudinal stripes. Head with two long conical processes on top ; yellowish green, with a brown stripe running down the sides. Length, 1⅛ inches.

Chrysalis.—Bright green, with the outer wing-cases margined with yellow, and three stripes on upper side of the body and one at the sides. Length, ⅜ inch.

Food-plants.—Grasses.

Not common in this vicinity. It has been taken near Newark, N. J., Staten Island, near Mount Vernon, N. Y., West Farms, N. Y., and various other localities. Found from the latter part of June, through July and August, flying in swampy places. Its flight is low, with a slow, jerking motion, and settles here and there among the tall grasses, and by beating these they may often be startled forth in numbers. The larva over-winters.

Debis portlandia (*Fabr.*).

PLATE IV, FIG. 9.

Butterfly.—Much the same in general appearance as *Neonympha canthus*, in color and markings on the upperside, but the black spots are larger. The wings are more elongate and are regularly scolloped on the outer borders, by which it may be readily distinguished from *N. canthus*, which has the wings rounded. The underside of both wings have the transverse bands much darker, broader, and the outer ones angulated, the angle pointing outward. The black spots from above are repeated and have a yellow ring; all the spots have a small white dot in the middle, and are also encircled by a pale violet ring, which is disconnected between the spots. Outer margins with a narrow pale violet and a dull yellow border. Expands about 2¼ inches.

Caterpillar.—Resembles that of *N. canthus*, but is stouter and the head is larger. Length, 1⅛ inches.

Chrysalis.—Also similar to that of *N. canthus*. It is bright green, and lacks the yellow stripes on the body. Length, ⅝ inch.

Food-plants.—Grasses.

Generally distributed in this vicinity, but is local. The flight is like that of *N. canthus*. It often rests on the trunks of trees, and sallies forth at any other passing butterfly, and retires again to its chosen post of observation. It also flies near the ground, along the edges of woods, or in the forests among bushes and trees. Found from the latter part of June to the first of August, and is single brooded.

Satyrus alope (*Fabr.*).

PLATE IV, FIG. 10.

Butterfly.—Upperside dark brown with a large yellow patch on the fore wings enclosing two black spots, and very much resembles the figure eight. Hind wing with only a small black spot near the anal angle. Underside with the yellow patch repeated on the fore wing, and towards the base are numerous short transverse brown streaks. Hind wings with six small eye-like spots with a light blue dot in the centre, and each surrounded with a yellow circle. These spots are more or less distinct. Across the wings are also short, dark brown streaks, and a narrow, transverse, irregular, wavy band across the middle. The female differs by being larger, somewhat paler in color, and the yellow 8-like patch larger and paler. The underside of the hind wings lacks the small eye-like spots. Expands 2 to 2½ inches.

Form **maritima** *Edw.*—Smaller in size, and dark brown, with the yellow patch deeper in color, and smaller.

Form **nephele** *Kirby.*—Differs from *alope* by the absence of the yellow patch on the fore wings, but the two black spots are present, and on the underside are conspicuous, with a narrow yellow circle, and are much larger in the female. Otherwise much the same as *alope.*

Caterpillar.—Body green, ending in two sharp conical tails; covered with fine papillæ, each of which emit a very short fine hair. On the dorsum a dark green line and along the extreme side a yellow stripe, and sometimes one of the same color along the sub-dorsum. Head globose, green, with fine white papillæ and short hairs. Length, 1¼ inches.

Chrysalis.—Green or yellowish green, with a cream-colored line along the inner margin of the wing-cases, another on the keel of the thorax, and one across the top of the head-case. Length, ⅝ inch.

Food-plants.—Grasses.

Found plentifully through July and August in grassy fields or in open woods, especially along the borders of woods, where the large trees have been felled and a young growth appearing. They fly low, but for a short distance, and rest upon the leaves of bushes or trunks and twigs of dead trees. The form *maritima* has been taken at Jamesburg, N. J. *Nephele* is a northern form, and very rarely occurs here.

Synopsis of the Species of Satyrinæ.

Outer borders rounded. **Neonympha.**
  Wood brown, with two eye-like spots in yellow rings on each wing.. *N. eurytris.*
  With a row of black spots in a light shade on each wing.... *N. canthus.*

Outer borders scolloped. **Debis.**
  With a row of black spots in a light shade on each wing.... *D. portlandia.*

Satyrus.

Wood brown, with yellow figure 8-like patch on the fore wings....... *S. alope.*
With yellow patch reduced and darker.......................form *maritima.*
With yellow patch absent..................................form *nephele.*

Subfamily LIBYTHEINÆ.

Libythea bachmanii *Hüb.*

PLATE V, FIG. 2.

Butterfly.—Fore wings blackish, with a large fulvous patch in the lower part of the cell, and a large patch beneath it near the base of the wing. In the black field at the apex are two white spots, and an oblique white patch on the costa before the spots. Hind wings with a large fulvous patch in the middle. Underside of fore wings with the markings as above; apex grayish. Hind wings grayish or finely speckled with brown, and if held in certain light have a metallic reflection. Expands 1¾ to 1⅞ inches.

Caterpillar.—Color dark green, with the extreme sides and beneath pale green. The segments are creased transversely, and have pale whitish points. Along the side is a yellow stripe and an indistinct dorsal line. Length, 1 inch.

Chrysalis.—Subtriangular, compressed laterally; head-case square; thoracic process rounded. Color blue green, with a faint yellow dorsal line from the last joint to middle of the body, where it is forked, sending a branch along each wing-cover to the top of the head-case and meeting. At the sides, from the end of the wing-cases to the end of the last segments, a narrow yellow line. The body is also marked with a number of small, whitish tubercles. Length, about ½ inch.

Food-plant.—Hackberry (*Celtis occidentalis*).

This species may be easily recognized by its long beak-like palpi, which are about twice as long as the head. It is quite rare here, but sometimes appears in numbers. In August, 1886, the butterfly was quite common at Sandy Hook, N. J.

Synopsis of Species.

With long beak-like palpi, black, with fulvous patches.........*L. bachmanii.*

LYCÆNIDÆ.

Thecla melinus (*Hüb.*).

PLATE V, FIG. 3.

Butterfly.—Upper wings slate-color, with a darker, indistinct patch at the end of the cell, in the male. Hind wings with a few blue scales along the outer border, interrupted by a large orange crescent enclosing a black spot, and at the anal angle is a small orange spot. The fringes of both wings are white, and the hind wings have one long slender tail and a short one, both black, tipped with white. Underside of both wings gray; fore wings with a brown and white spot-like band. Hind wings with a similar band, but running across the wing. The orange and black spot from above repeated; anal angle black and orange. Expands about 1¼ inches.

Caterpillar.—Slug-shaped. Pale green, with a dorsal yellow stripe, and a white stripe along each side. Length, ⅖ inch.

Chrysalis.—Testaceous, discolored and flecked with dark brown ; abdomen wider than thorax, with long hairs. Length, ⅓ inch.

Not common during May, June, July and August. The larva lives on the heads of the common Hop vine, and also on the Bean. Double brooded.

Thecla calanus (*Hüb.*).

PLATE V, FIG. 4.

Butterfly.—Upper surface of both wings wholly sepia brown, with a brassy green reflection. Underside paler than above ; beyond the middle is a double, broken, white transverse stripe, with the space between sepia brown ; beyond this band is a single narrow white band edged outside with brown. In the disc are two short white lines. Hind wings with similar bands, but are more curved. Before the outer border, towards the anal angle, is an oval crescent enclosing a black spot ; then comes a patch of blue scales, and on the anal angle a black spot sometimes marked above with a little white and orange. Expands 1 to 1¼ inches.

Caterpillar.—Body yellowish green, deep green or pale brown, thickly covered with minute white hairs ; along the dorsum a green or dark brown stripe ; sides of body with five or six oblique lines. Length, ½ inch.

Chrysalis.—Light or dark brown sprinkled with dots of a darker shade, and is thickly covered with short yellowish hairs. Length, ⅜ inch.

Food-plants.—Oak, Chestnut, Hickory and Walnut.

Not common in this vicinity during June and July, in woods and about shrubbery. Single brooded.

Thecla strigosa (*Harris*).

Butterfly.—Upperside like that of *Thecla calanus*, sometimes with an orange spot near the anal angle of the hind wings, which have a long slender and a short tail tipped with white. Underside paler than above, with a very short white line at the end of the cell ; beyond which are four fine, irregular, wavy, white lines, the first almost reaching across the wing, the second shorter, and the third still shorter, while the fourth almost reaches across the wing. Hind wings with the first line nearly extending across, then bending at a small angle and running some way up the abdominal margin, preceded in this last part by another short line, almost parallel to it. The outer lines are shorter. Before the anal angle is a large orange spot followed by a patch of blue scales with an orange patch above, which is connected with the patch of the same color at the anal angle. Expands 1 to 1¼ inches.

Caterpillar.—Body rich velvety green, with a yellowish tinge, and a darker colored dorsal stripe. Anterior edge of the second segment brownish. Body thickly covered with minute brown hairs, hardly visible without a lens. Sides with faint oblique yellowish stripes and an indistinct basal line from the fifth to last segment. Length, ½ inch.

Chrysalis.—Resembles that of *T. calanus.* Reddish brown with very short, fine, whitish hairs, and with black markings and a dark ventral line on the body. Length, ⅓ inch.

Food-plants.—Oak, Holly, Thorn, Plum and Apple.

Very rare in this neighborhood. Taken by Dr. R. Kunze near Woodhaven, L. I. ; also recorded from Newark, N. J., by Prof. Smith ; an example taken in this vicinity is also in the collection of the late S. L. Elliot. It is closely allied to *Thecla calanus*, but differs in the position and number of white lines on the underside.

Thecla damon (*Cram.*).

PLATE V, FIG. 5.

Butterfly.—Wings above dark brown, with the middle area ochraceous. Hind wing with two tails, one long and the other short. Underside of fore wings thickly scaled with green, and a transverse band of white and brown before the outer border. Hind wings with the green covering the entire surface, and a wavy transverse white and brown band a little beyond the middle, and a short white and brown band near the base of the wing. Expands 1 inch.

Caterpillar.—Green with two rows of small red spots along the back, and on each side a row of somewhat larger and deeper red spots. Head and feet blackish. Length, ½ inch.

Chrysalis.—Grayish brown, marked with dark brown, and covered with hair ; body more clear and reddish. Length, ⅓ inch.

Food-plant.—Red Cedar.

Found on the wing in May and June, and again in August. It occurs only in localities where cedar trees grow. The butterfly, when disturbed, flies for a short distance and suddenly drops to the ground, folding its wings, and owing to the green color on the underside, it is quite difficult to detect the insect in the grass. In this vicinity it has been taken at West Farms, Rye, Nepperhan and Staten Island, N. Y.; Plainfield, Newark and Passaic Valley region, N. J., and also in different places on Long Island and in New Jersey.

Thecla irus (*Godt.*).

PLATE V, FIG. 6.

Butterfly.—Upper surface dark brown, with a slight greenish reflection, and sometimes with a ferruginous patch on the hind wings near the anal angle. The border of the hind wings is toothed, the teeth becoming longer as they reach the anal angle. Underside of fore wings paler than above, with a narrow transverse white line, followed by a row of indistinct dark spots. Basal half of hind wings blackish brown, limited by an irregular zig-zag line, outer half overlaid with whitish scales. Expands 1 inch.

Caterpillar.—Slug-shaped. Yellowish green along the dorsum and reddish brown along the sides, with a fine green lateral line along the fold. Head minute, yellowish green. Length, $\frac{1}{2}$ inch.

Chrysalis.—Black or blackish brown, with dull red bands and a narrow black stripe on each side in the middle of the body, not extending to the thorax. Length, $\frac{8}{16}$ inch.

Food-plants.—Wild Plum and Huckleberry.

Not common, occurring in April and May, especially in pine woods and open places.

Thecla augustus (*Kirby*).

Butterfly.—In color on the upper surface and in shape this insect is like *Thecla irus*, but differs greatly on the underside of the hind wings, which have the basal half deep brown with the outer half of a ferruginous tint, with a row of minute dark spots. Fore wing somewhat lighter. The wings have a decided brassy reflection. Expands $\frac{4}{5}$ to 1 inch.

Taken in pine woods on Staten Island, in April and May. The early stages are unknown.

Thecla niphon (*Hüb.*).

PLATE V, FIG. 7.

Butterfly.—Upperside sepia brown with a small ochraceous spot at the anal angle of the hind wings in the male, and a large ochraceous space in the middle of each wing of the female. Underside of fore wings paler than above, and washed with ferruginous. Beyond the middle is a zig-zag white line not reaching the inner border. Beyond this is a submarginal row of dark brown spots, shaded outside with brown and whitish rays. Hind wings with basal half ferruginous, with blackish transverse shades limited by a white zig-zag band shaded outside with grayish brown ; beyond this the color is ferruginous with pale grayish scales along the outer margin. Expands 1⅕ inches.

Caterpillar.—Slug-shaped. Deep green, with a light yellow stripe along the middle of the back, and a white one on each side. Head brown. Length, ¾ inch.

Chrysalis.—Short, thick, brown, with two rows of small blackish spots, and outside of these a row of more conspicuous, rust-red spots.

Food-plant.—Pine.

Very rare in this vicinity, and found only in pine woods in April and early in May. Single brooded.

Thecla titus (*Fabr.*).

PLATE V, FIG. 8.

Butterfly.—Upper surface wholly sepia brown, with a distinct grayish-brown spot at the end of the cell in the male. Underside paler than above, fore wings with two rows of black spots, the outer row touched with orange. Hind wings somewhat produced at the anal angle with a row of black spots, and an outer row of large orange-red spots, touched with black and white on the inside ; in the cell are two black spots. The female has the wings more rounded than the male. Upperside sepia brown, with two, three or four orange-red spots along the outer border of the hind wings. Underside like the male, only the spots are larger. Expands 1¼ to 1⅓ inches.

Caterpillar.—Slug-shaped. Dull green, with a yellowish tint, especially on the anterior segments, thickly covered with very minute brown hairs. On the back is a streak of dark green and a patch of dull pink or rose color on the anterior segments ; on the posterior segments a larger rosy patch, extending from ninth segment to the end of the body. Head small, bilobed, black and shining, with a streak of dull white across the front above the middle. Length, ¾ inch.

Chrysalis.—Body pale brown and glossy, with many small dark brown or blackish dots over the whole surface, thicker along the middle above, and appearing as a faint imperfect stripe beneath ; also thickly covered with very short, minute hairs. Length, about ½ inch.

Food-plants.—Plum and Wild Cherry.

Rare. Taken at Pelhamville, N. Y.; Jamesburg, Snake Hill, and near Newark, N. J., and probably also occurs on Long Island and other localities. Single brooded. July.

Feniseca tarquinius (*Fabr.*).

Plate V, Fig. 9.

Butterfly.—Upperside orange ochraceous. Fore wings with a broad blackish brown outer border, which is narrowly continued along the inner margin and on the costa, where it forms an angular patch. At the base beneath the middle of the wings is a blackish brown dash, beyond which is a round spot of the same color. Hind wings have the anterior half blackish brown, and a series of spots of the same color near the outer border. Underside pale orange yellow, with three rusty-brown spots beneath the costa at the base of the wing, and the blackish basal dash and spot beyond it repeated. Outer border rusty brown, with a whitish patch before the apex on the costa, and rusty brown patches before it. Hind wings rusty brown with numerous white circles, and washed with white. Exands 1⅛ to 1¼ inches.

Caterpillar.—Head small, pale green. Body largest in the middle, tapering in each direction, with short hairs arranged in transverse patches across each segment, and smoky brown with smoky stripes. Length, about ½ inch.

Chrysalis.—Plump with swollen body, which is covered with slight bosses, and the hinder extremity flattened and laterally expanded. Pale on the thorax, flecked with brown; dark greenish brown on the abdomen, flecked or blotched with cream yellow. Length, ⅓ inch.

Food.—Plant-lice living on Alder.

Very rare and local in this neighborhood, and only occurs where alders grow. The caterpillar feeds on the lice (*Schizoneura tessellata*) which infest this tree, and probably also feeds on other lice, which exude a waxy secretion and live in colonies. It is three brooded; the first brood appearing from the latter part of May to the middle of June; the second early in July and flies into August; the third from the middle of August to the end of September.

Chrysophanus hypophlæas (*Bdv.*).

Plate V, Fig. 11.

Butterfly.—Upperside of fore wings deep orange red, with a satiny gloss; a rather broad brown outer border, before which is a row of black spots and two spots in the cell. Hind wings dark brown with a short orange-red terminal border. At the end of the cell is an indistinct dark bar. Underside of fore wings orange, with the spots from above repeated, and an additional spot at the base of the wing. Outer border pale brownish gray. Hind wings pale brownish gray with the red outer band from above reduced to a narrow wavy line. Beyond the middle is a transverse row of black spots and a few spots in the basal area. Expands 1 inch.

Caterpillar.—Slug-shaped. Body with minute hairs, grass green, with a faint dusky dorsal line and darker, sometimes roseate, along the sides. Length, about ⅜ inch.

Chrysalis.—Light brown tinged with yellowish green, dotted with blackish, the dots on the body arranged longitudinally in a dorsal series and on either side, above and including the spiracles, five series, sometimes faint. Length, about ⅜ inch.

Food-plant.—Sorrel.

Very common in open, sunny fields and meadows, from May to October, and in this vicinity it is two or three brooded.

Chrysophanus thoë (*Bd.-Lec.*).

PLATE V, FIG. 10.

Butterfly.—Upperside of the male coppery brown, with a purplish reflection and a narrow black outer border. Hind wings darker, with a broad orange-red border. Both wings show traces of the spots on the underside. The female has the fore wings orange ochraceous with a number of black spots and a broad, deep brown outer border. Underside of fore wings light orange ochraceous; hind wings grayish white, with the terminal border as above, orange-red. Both wings with three rows of black spots and a few spots at the basal half. Expands about 1½ inches.

Caterpillar.—Slug-shaped. Head minute, pale. Body bright transparent green, having a velvety appearance, with a dark green dorsal stripe edged with yellow, the whole profusely dotted with minute white mushroom-shaped appendages. Length, about 1 inch.

Chrysalis.—Light yellowish brown, the body with six longitudinal series of obscure fuscous dots on each side (including those beneath) and a few dots on the thorax. Length, about ½ inch.

Food-plants.—Smart-weed (*Polygonum*) and *Rumex*.

This butterfly is double brooded, and is not common in this vicinity. It is found in swampy places. The first brood appears in June and early in July, and the second in the middle of August to the middle of September.

Lycæna comyntas (*Godt.*).

PLATE V, FIG. 13.

Butterfly.—Upper surface in the males wholly violet-blue, with very narrow black outer border; fringes white. The hind wings are provided with a fine thread-like tail near the anal angle, and sometimes with a row of more or less distinct black spots along the outer margin. The spot before the tail sometimes orange. Underside whitish gray, with a double row of gray spots along the outer margin of both wings and another row of black spots encircled with white, between the cell and the outer rows of spots. At the end of the cell is a short gray bar. The hind wings have also two black spots near the base, and near the anal angle are two orange crescents enclosing a black spot surrounded with silvery scales. The female is blackish brown, sometimes bluish at the base. Expands ¾ to 1 inch.

Caterpillar.—Slug-shaped. Head black; body greenish or brownish, with darker green lines and oblique lines on the sides. Length, ⅓ inch.

Chrysalis.—Color greenish brown or dull whitish, with three rows of black dots, and covered with a few whitish hairs. Length, ¼ inch.

Food-plants.—*Lespedeza, Desmodium* and Clover.

Common in meadows, clover fields and roadsides from May to September. Three brooded. The caterpillar feeds on the flower heads and tender leaves of the plants.

Lycæna scudderii *Edw.*

PLATE V, FIG. 12.

Butterfly.—Allied to the preceding species, but is larger and wants the thread-like tail on the hind wings. The color on the upperside is the same. Underside deeper gray than in *L. comyntas*, with the spots much heavier and larger, and a distinct row of orange crescents on the hind wings before the outer margin, each enclosing a black spot, with silvery scales. The female is blackish brown above, with bluish scales at the base. Hind wings with a row of orange crescents along the outer border and each enclosing a black spot. Expands 1⅛ inches.

Caterpillar.—Slug-shaped. Dull green, with a velvety appearance, caused by the presence of many short fine hairs and minute brownish dots, hardly visible without a lens. Along the back is a deeper green stripe, margined faintly with a blue shade. Along the sides is a series of oblique lighter stripes and a cream-colored stripe along the extreme sides. Underside similar in color to the above, with a blackish tinge along the middle. Length, over ⅓ inch.

Chrysalis.—Pea-green, body tinged with yellow, except dorsal line, pea-green. Body covered with delicate tracery, forming a broken, irregular, reticulation of raised lines, and with short fine hairs. Length, ⅜ inch.

Food-plants.—Lupines.

Very rare in this vicinity. A number from this neighborhood are in the collection of the late S. L. Elliot, now in the American Museum of Natural History. Double brooded. May–June and July–August.

Lycæna pseudargiolus (*Bd.-Lec.*).

PLATE V, FIG. 14.

Butterfly.—Upperside wholly azure blue, with a narrow black outer border. The female is paler blue and has a very broad black outer border extending along the costa in some specimens. Hind wings with a terminal row of blackish spots ; costa also washed with black. Underside whitish ; a row of spots along the outer margin and another row before it, and several small blackish spots on the basal area. Expands 1 to 1⅜ inches.

This species is subject to great variation, and the following forms are also found in the vicinity of New York City :

Form **lucia** *Kirby.*—Upper surface violet blue. Underside gray, with the two rows of terminal spots running together and forming a distinct band on both wings, preceded by a row of rather large blackish spots. The spots on the basal part of the hind wing run together and form a distinct patch.

Form **marginata** *Edw.*—Much the same as the form *lucia*, but the spots in the basal area of the hind wings beneath do not run together.

Form **violacea** Edw.—The rows of spots along the outer borders of both wings do not run together as in the two preceding forms, and the spots in the basal area are also distinct.

Form **neglecta** *Edw.*—Resembles *pseudargiolus*, but is smaller, not expanding more than a little over an inch.

Caterpillar.—Very variable in color and markings. In spring it is whitish often stained with red, or brown, light or dark ; sides olive green, with a darker green or dull red patch along the posterior edge of each joint. Beneath it is pale green. In summer it is white or pale green, second joint brown, or has the sides dark, often with patches over it, or is pale green with a broken dark green band along the back, and another one along the base. Sometimes the entire surface is wine red or chocolate brown. Color in fall, green, with more or less brown, irregular patches. Head, dark brown. Length of spring larva, ⅜ inch ; of summer larva, ½ inch.

Chrysalis.—Dark brown or yellow, also varying ; the wing-cases dark, and sometimes greenish. On the body are two subdorsal rows of blackish dots and sometimes a dark dorsal line. Length, about ½ inch.

A very common insect here, and is found in open sunny places, especially in woods. The forms *lucia*, *marginata* and *violacea* are found in April and early in May. The forms *neglecta* and *pseudargiolus* are found in the summer until September. The winter forms lay their eggs in the flower buds of the Dogwood (*Cornus florida*), and the following brood deposit their eggs on the flower stem of the black snake-root (*Cimicifuga racemosa*), and the fall brood are found on *Actinomeris*. The following food-plants have also been given: Wild bean (*Apios tuberosa*), *Spiræa salicifolia*, *Ceanothus americanus*, and Ilex.

Synopsis of the Species of Lycæninæ.

Thecla.

- Hind wings with tails.
  - Slate gray, with an orange spot at the anal angle of hind wing. *T. melinus.*
  - Sepia brown, with a double, broken, white transverse band on both wings beneath. .... *T. calanus.*
  - Sepia brown, with four irregular, wavy white lines across the upper wing beneath.... .... *T. strigosa.*
  - Thickly scaled with green on the underside, with wavy white and brown transverse bands............ .... *T. damon.*
- Hind wings strongly toothed.
  - Outer half of hind wing beneath heavily overlaid with whitish scales. *T. irus.*
  - Hind wings beneath ferruginous with zig-zag transverse lines.. *T. niphon.*
- Hind wings not toothed.
  - Underside of hind wings with outer half ferruginous........ *T. augustus.*
- Hind wings with outline evenly rounded, ♀; hind angle produced, ♂.
  - Underside of hind wing with an outer row of large orange spots. *T. titus.*

Feniseca.

- Wings ochraceous, with black border.
  - Underside of hind wings with many whitish rings......... *F. tarquinius.*

Chrysophanus.

- Small size, glossy orange red.
  - Hind wing beneath brownish gray with black spots .. ....*C. hypophlæas.*
- Large size with black spots.
  - Underside of wings whitish, with black spots.............. ....*C. thoë.*

Lycæna.

- Hind wings with a thread-like tail.
  - Underside of hind wings with two orange spots ....*L. comyntas.*
- Without thread-like tail on hind wings.
  - With terminal row of orange spots on underside of hind wings. *L. scudderii.*
  - Without orange spots on hind wings beneath . .. .*L. pseudargiolus.*
  - Smaller than *pseudargiolus* .. .. form *neglecta.*
  - Spots on underside running together ... . form *lucia.*
  - Spots on basal area of hind wings not running together...form *marginata.*
  - Terminal rows and basal spots on hind wing prominent, not running together....... ....form *violacea.*

HESPERIDÆ.

Ancyloxypha numitor (*Fabr.*).

PLATE VI, FIG. 20.

Butterfly.—Upperside of fore wings blackish, washed with orange ochraceous. Hind wings orange ochraceous bordered with black. Underside of fore wings blackish bordered, orange ochraceous along the costa and outer margin. Hind wings wholly orange-ochraceous. Body white beneath; at the side orange, above blackish brown. Expands about 1 inch.

Common in grassy places in June, July, August and September, and is three brooded. The early stages are only imperfectly known.

Pamphila massasoit *Scudder.*

PLATE VI, FIG. 2.

Butterfly.—Upperside of male wholly blackish brown, sometimes with a row of three small spots below the costa before apex on the fore wing. Underside of fore wings blackish brown, with the costa and outer margin scaled with yellowish brown. The three spots on the costa from above are repeated, and there are sometimes one or two minute yellow spots in the middle of the wing. Hind wings with a very large bright yellow patch in the middle, the borders of the wing dull orange ochraceous, becoming lighter toward the anal angle. The female has three small yellow spots on the costa beyond the middle, and two larger yellow spots in the middle of the wings, and in the middle of the hind wings a row of two to seven yellow spots. Underside similar to the male. Expands about 1¼ inches.

Not common in this vicinity. Found in July and August. The caterpillar feeds on grasses.

Pamphila zabulon (*Bd.-Lec.*).

PLATE VI, FIG. 1.

Butterfly.—Upperside of male orange ochraceous, with outer border blackish brown, dentate within; the same extending along the hind margin. At the end of the cell is a narrow oblique bar and a patch beyond touching the apical portion of the border. Hind wings bordered all around with blackish brown. Underside of fore wings paler yellow than above, with the outer border also paler, and at the base a large dark brown patch. Hind wing bright yellow with a faint, broken, brownish outer border; base of the wing brown, containing a yellow patch. Expands 1⅛ inches.

Var. **hobomok** *Harris.*—Differs from the preceding by having the markings above heavier. Hind wings beneath have the yellow reduced to a band ; basal part of wings brown tinged with yellow, and a broad brown continuous outer and inner border with grayish scales. The female has the veins brown, and is suffused with this color over the basal half of the fore wings above, otherwise it resembles the male.

Dimorphic female **pocahontas** *Scud.*—Upperside brown with three small spots on the costa and a few indistinct whitish spots in the middle of the fore wing. Hind wings entirely brown. Underside similar to the above, with the pale yellowish spots in the middle of the wing forming an irregular patch. Hind wings with the yellow band as in *hobomok*, but entirely covered with brown or gray scales.

Caterpillar.—Head dark reddish brown, rough. Body naked, yellowish brown, with a dark line along the middle of the back, two lateral lines and dotted with brown. First segment green, with a brown, narrow, interrupted thoracic shield. Length, ⅘ inch.

Chrysalis.—Uniformly livid, somewhat infuscated on head and thorax, the appendages with a whitish bloom ; tongue-case extending to the eighth abdominal segment. Length, about ⅗ inch.

Food-plants.—Different species of Grasses.

The form *hobomok* is common in this neighborhood along the edges of woods and sunny wood paths during the latter part of May, through June, and disappears early in July. The butterfly flies close to the ground, and settles on leaves of plants when at rest. Single brooded. The form *zabulon* is rare, and the dimorphic female *pocahontas* is occasionally common, especially in the mountainous district in New Jersey.

Pamphila sassacus (*Harris*).

PLATE VI, FIG. 3.

Butterfly.—Upperside of fore wings dull orange ochraceous, with a broad blackish-brown outer border crenate within ; base of wings dusky. On the wings beneath the cell is a velvety black, oblique dash ; beyond this black dash is a brownish patch. Hind wings with the yellow surrounded by a broad blackish-brown border. Underside ochre yellow, blackish at the base ; near the apex on the costa are traces of a short row of spots. Hind wings ochre yellow with an indistinct curved row of paler spots in the middle. The female differs by the absence of the black dash on the fore wing above, and on the underside the spots near the apex and middle of hind wing are more distinct and more black at the base of the fore wings beneath. Expands 1⅓ to 1½ inches.

Not common in this vicinity in May and June. Taken at West Farms and Staten Island, N.Y., Caldwell and Newark, N. J., and different places on Long Island. The caterpillar feeds on grasses.

Pamphila logan (*Edw.*).

PLATE VI, FIG. 4.

Butterfly.—Upperside orange yellow with the veins dark brown, as also is the narrow outer border. Hind wings also orange yellow surrounded with a brown border. Underside somewhat paler than above, without brown veins, only the basal part of the fore wings is blackish brown. Hind wings wholly clear orange yellow. The female has the basal portion above blackish brown, and also the inner and outer borders. Hind wings have the borders broader. Underside similar to the male, clear orange yellow. Expands 1⅓ inches.

Caterpillar.—Head oval, oblique, white, smooth, slightly bilobed. A black band about the top and sides; a black vertical streak on the middle of the face, and a short streak on either side of this last. Body bluish white, with a small black band on the last segment and anal plates. Surface thickly dotted with white and black tubercles. Shield on first segment black, including a dot on either side. Length, about 1 inch.

Chrysalis.—Narrow, greenish white; head-case blunt, black, with tubercles and bristles. Last segment black. Length, ½ inch.

Food-plants.—Grasses.

Exceedingly rare in this vicinity, but is common in the Southern States. Found from June to the middle of August. Single brooded.

Pamphila leonardus (*Harris*).

PLATE VI, FIG. 5.

Butterfly.—Upperside dark brown, thickly overlaid with dark orange ochraceous scales from the base to beyond the middle of the fore wings. Below the costa in the brown outer field is a row of three small spots and two spots beneath it, and a larger spot at the end of the cell, beneath which is a slightly curved black dash or stigma. Hind wings with a curved central band, composed of spots, and not reaching either margin; towards the body the wings are more or less covered with orange ochraceous hairs. Underside blackish, washed with dark orange ochraceous along the costa and outer margin. The light spots from above are repeated, with the addition of a yellow patch beneath the spot at the end of the cell. Hind wings inclined to be ferruginous, with a pale yellow or white spot near the middle ; beyond which is a curved row of rather large, distinct, yellow or whitish spots. The females lack the black stigma beneath the cell on the fore wing, and in addition have three large yellow spots from the end of the cell running towards the inner margin. Underside like the male. Expands 1½ inches.

Rare in this vicinity. Taken in August and early in September, in open fields. The caterpillar feeds on grasses, and is only imperfectly known.

Pamphila huron (*Edw.*).

PLATE VI, FIG. 6.

Butterfly.—Upperside of fore wings orange ochraceous, the outer border blackish brown, dentate within. Beneath the cell is a curved velvety black dash or stigma, below which is a rounded patch of raised brownish scales. Before the apex, touching the outer border, is a small blackish brown patch. Hind wings with the middle portion dull orange ochraceous, sending rays in the blackish brown outer border around the wing. Underside of wings ochre yellow, sometimes tinged with pale blackish around the borders ; fore wings blackish at the base and indications of a few subterminal spots. The female is blackish brown, and lacks the stigma and raised scaly patch. The fore wings are washed with orange ochraceous along the costa and inner margin from the base to about the middle of the wing, with a blackish patch between, at the end of which is a quadrate, semitranslucent spot and a smaller one a little beyond. Near the apex beneath the costa is a row of three small spots and two a little beyond and beneath. Hind wings with a curved band of orange ochraceous spots in the middle. Underside of fore wings ochre yellow, with base along costa orange and blackish below at the base ; the spots from above are repeated. Hind wings ochre yellow with two paler rows of curved spots. Expands 1⅛ to 1⅛ inches.

Caterpillar.—Pale green, more or less clouded with darker green and sprinkled profusely with very minute blackish papillæ, each with an exceedingly short hair. Thoracic shield black, edged in front by a light band. Thoracic feet blackish. Length, 1⅛ inches.

Chrysalis.—Dark reddish brown. Head with three large, round, light-brown spots, arranged triangularly. Abdomen testaceous mottled with blackish brown spots. Length, ⅞ inch.

Food-plants.—Different species of Grasses.

Very rare in this vicinity. Has been taken in Van Courtland Park, N. Y., and Newark, N. J. Single brooded.

Pamphila phylæus *Drury.*

PLATE VI, FIG. 7.

Butterfly.—Upperside bright orange ochraceous, outer border blackish brown, and is broken into short lines running inwards. Beneath the cell is an oblique dash, to which is connected an elongated, velvety patch of elevated, brown scales. At the base of the wings are three black streaks, the lower one touching the black dash. At the end of the cell are two short blackish brown dashes. Hind wings light orange ochraceous with the outer brown border dentate within. Underside paler than above. Fore wings blackish at the base and along the hind margin; a black spot beneath the cell, one at the end, and a row of subterminal spots. Hind wings with a blackish streak running from the base, within the inner margin to nearly the anal angle, and a number of blackish spots. The female differs from the male by being brown, with the basal portion slightly washed with yellow; at the end of the cell is a small yellow spot, an oblique broken row beyond, and three small spots in a row beneath the costa near the apex. Hind wings with a row of broken spots in the middle. Underside dirty yellow, blackish brown at the base; the oblique row of spots from above paler yellow and forming a broken patch. Hind wings dirty yellow, somewhat tinged with brownish, with the spots as in the male. Expands 1⅛ to 1¼ inches.

Caterpillar.—Spindle-shaped. Dull green and thickly granulated with pale points; thoracic plate on first segment dark brown; head small, punctured, dark brown. Length, ¾ inch.

Chrysalis.—Nearly cylindrical; head, thorax and abdomen pubescent. Pale green with a black, broken line extending from back of the head-case to the end of the body, a lateral black streak and a row of black dots on the body; wing-cases paler, contracted behind into a point; anal hook stout, spine-like. Length, ½ inch.

Food-plants.—Various species of Grasses.

Exceedingly rare in this vicinity, but is a common insect in the Southern States. Taken late in October in Bayonne, N. J., and Astoria, L. I., by Dr. R. Kunze; also taken at Clifton, N. J., by Prof. J. B. Smith.

Pamphila otho (*Abb. & Sm.*).

PLATE VI, FIG. 8.

Butterfly.—Upperside dark brown washed with orange ochraceous on the costa at the base. Beneath the cell is a short velvety black dash or stigma, with a patch of raised scales beneath it towards the base of the wing, containing a small black spot ; at the end of the black stigma is an orange spot and three small ones in a row below the costa near the apex. Hind wings with yellowish hairs over the basal and inner part. Underside of fore wings brown, costa and apex rusty brown ; the yellow spots from above repeated. Hind wings rusty brown, with an indistinct band in the middle. The female wants the orange ochraceous scales along the costa at the base, and the stigma beneath the cell, at the end of which are two spots instead of one, and one beneath these. Underside like that of the male. Expands 1⅕ to 1¼ inches.

Var. **egeremet** *Scud.*—Differs from *otho* in having the yellow tinge on the upperside somewhat olivaceous, as also the underside of both wings. The markings above and below are similar.

Caterpillar.—Body light green mottled with dark green, and becoming hoary in the middle of the upper surface. A dark green dorsal line ; a dull yellow stigmatal band, broader so as to occupy the whole dorsal part of the body (except the dorsal stripe) beyond the seventh segment and tinged with pinkish on the posterior third of body. A slender, indistinct, greenish line, followed by a yellowish green band. First segment crossed by a narrow black band. Length, about 1 inch.

Chrysalis.—Head brownish green ; tongue pink ; thorax dull grass green ; suture pinkish brown ; abdomen dull yellowish green ; spiracles and cremasters pink. Length, ⅗ inch.

Food-plants.—Different kinds of Grasses.

Rather scarce in June and July. The variety *egeremet* is more common than *otho*, which is abundant southward. Single brooded.

Pamphila peckius (*Kirby*).

PLATE VI, FIG. 9.

Butterfly.—Upperside brown ; basal half of fore wings yellow ; beneath the cell is an oblique black dash, and below this an opaque, brown patch. Before the apex is a row of three yellow spots below the costa, two a little beyond and beneath and one at the end of the velvety black stigma. Hind wings with a band of four spots in the middle and with orange ochraceous hairs. Underside of fore wings washed with orange ochraceous along costal area and outer portion ; spots from above repeated, there being eight of them instead of six. Hind wings dull orange ochraceous with a broad ochre yellow band composed of six oblong spots, the third spot from the costa being longest ; at the base is also a row of spots connected with the large spot of the other band. The female differs by the absence of the black stigma and having at the basal part dashes of yellow, and beyond the middle an oblique row of irregular spots. Hind wings and underside like the male. Expands 1 inch.

Found everywhere in meadows, and is one of the most common species of Hesperians in this vicinity. It is double brooded, the first brood appearing in the latter part of May to the middle of July, and the second brood in August and September. The caterpillar feeds on grasses, and is only imperfectly known.

Pamphila mystic (*Edw.*).

PLATE VI, FIG. 10.

Butterfly.—Upperside orange ochraceous; outer border dark brown; beneath the cell is a velvety black, oblique stigma, limited beneath with a deep brown patch of raised scales and a spot of the same color at the end. Beyond and attached to the stigma is an irregular, yellow band. Hind wings with a band-like patch in the middle, outer borders deep brown, of which color are also the veins in the yellow part. Underside ochre yellow, with the black stigma and spot from above faintly indicated. Hind wings ochre yellow with a lighter curved band in the middle and a spot in the cell. This band and spot are more or less distinct. The female is deep brown with a yellow patch in the cell and an oblique row of spots beyond. Hind wings somewhat like those of the male, but not shaded with as much yellow, the band being smaller. Underside same as in the male. Expands 1¼ inches.

Caterpillar.—Dull brownish green, with a dorsal line and sprinkled with darker dots. Second segment whitish, with a blackish band across. Head dull reddish brown with very minute whitish hairs, which also cover the body. Length, 1 inch.

Food-plants.—Grasses.

Rare in this vicinity, and is found in open grassy meadows late in May and through June, and again in August and September. The chrysalis is unknown.

Pamphila cernes (*Bd.-Lec.*).

PLATE VI, FIG. 11.

Butterfly.—Upperside brown with a slight olivaceous tint. Beneath the cell is an oblique velvety black stigma, above which is an orange ochraceous patch on the costa, beneath the stigma and at base of wings washed with yellow. At the end of the stigma is a small yellow spot, and three in a row below the costa before the apex. Hind wings with olivaceous hairs towards the base. Underside with the yellow patch on the costa reproduced, and traces of two spots beneath the cell; outer part of wings olivaceous, basal part blackish. Hind wings olivaceous. The female differs in having less yellow on the costa; by the absence of the black stigma, and in having a row of three spots at the end of the cell, running towards the hind margin. Expands 1 inch.

Caterpillar.—Rich purplish brown with a green tinge, finely mottled with gray and dark purplish brown; first segment milk-white above with a piceous shield. Length, about 1 inch.

Chrysalis.—Light brown with slight and delicate infuscations, the thorax darker, the head black, the whole dotted sparsely with reddish brown. Tongue-case reaching to the eighth segment. Length, ½ inch.

Food-plants.—Various species of Grasses.

Very common from May to September inclusive in grassy meadows. Double brooded.

Pamphila manataaqua (*Scud.*).

Butterfly.—Upperside with light orange ochraceous; beneath the cell is an oblique velvety black stigma, which is connected with a narrow basal streak; before the apex beneath the costa are three spots, which seem to be a continuation of the yellow streaks on the costa. Outside of the black stigma are two or three spot-like marks. Outer part of wings dark brown. Hind wings have an ochraceous shade on the inner half. Underside, along the costal half, orange; other half brown. The spots from above repeated. Hind wing ochre yellow with an obsolete curved row of paler spots in the middle. The female lacks the black stigma and has the spots beyond larger. Expands 1 to 1⅛ inches.

Not rare in this vicinity. Found in June and July, and is single brooded. The larva feeds on grasses. The fully-grown larva and chrysalis are unknown.

Pamphila verna *Edw.*

PLATE VI, FIG. 12.

Butterfly.—Upperside deep brown with a slight olivaceous tint, especially the hair on the hind wings and body. Below the cell in the fore wings is an oblique, velvety black stigma, with three semitranslucent, pale yellowish spots beyond, the middle one being largest; before the apex below the costa are three small spots in a row of similar color. Underside paler, with spots repeated. Hind wings with an indistinct curved row of minute light spots in the middle. The female similarly colored as the male, but lacks the oblique velvety black stigma, and has an additional whitish spot. Underside with the spots repeated, otherwise like the male. Expands 1⅛ inches.

Caterpillar.—Body yellowish or wood-brown with a russet tinge along the upper half, flecked uniformly and profusely with minute dark brown spots and covered by pale brown short hairs ; a slender dorsal stripe of blue black and two similar stripes along the sides, fading away at either extremity beyond the third thoracic and seventh abdominal segments, and a faint similar stripe below the spiracles, scarcely perceptible. Underside paler than above, with a greenish tinge. Head castaneous, edged with black behind, covered with minute points and with pale brown hairs. Length, ¾ inch.

Food-plants.—Grasses.

Not common in June and July, in grassy meadows. Single brooded.

Pamphila metacomet (*Harr.*).

PLATE VI, FIG. 13.

Butterfly.—Upperside wholly dark brown, with a slight olivaceous gloss. Beneath the cell is the oblique velvety black stigma in the male. Underside paler than above and not glossy. Hind wings have sometimes a few minute spots in the middle. The female lacks the oblique stigma, and has two pale yellow dots in the wing a little beyond the middle, and one or two more below the costa near the apex. Underside with the spots reproduced. Expands 1¼ inches.

Not common in June and July. The butterfly may be easily recognized by its dark color without pale marking in the male. It is found in fields and open grounds. Single brooded. The earlier stages are unknown.

Pamphila accius (*Abb. & Sm.*).

Butterfly.—Upperside deep brown, with a very slight olivaceous tint. Male with an indistinct velvety black oblique stigma, at the end of which is a minute white dot and a row of three above it beneath the costa. Underside deep rusty brown along the costal area, and the outer margin beneath the apex tinged with violet. Spots from above reproduced. Hind wings are deep rusty brown with a violet patch near the base and one on outer margin. The female lacks the black stigma, and has a row of three white spots beyond the middle, and the three beneath the costa also present a small dot about the middle of the wing immediately below the costa. Underside with spots repeated, otherwise like the male. Expands 1¼ to 1⅜ inches.

Caterpillar.—Slender ; nearly white, but under a lens mottled and dotted with darker lines and points ; collar black ; head small, oblique, oval, flattened frontally, white with a black band around the top and sides, a black streak down the middle of the face and a short black streak on either side of this last, and not reaching the band at top. Length, 1⅓ inches.

Chrysalis.—Slender, smooth, white; head-case tapering into a slender pointed beak. Length, 1 inch.

Food-plants.—Grasses.

Very rare in this vicinity, but a common insect in the Southern States. Recorded by Prof. Smith from Salem, N. J. Readily known by the violet shades on the underside. June–July.

Pamphila ocola (*Edw.*).

Butterfly.—Upperside deep brown, with a slight bronzy lustre with a semi-translucent spot at the end of the cell and a small dot a little beyond, sometimes traces of a third spot beneath the large one. Underside paler than above, with the spots repeated. Hind wings above and below without markings. Expands 1⅘ inches.

Very rare. Recorded by Prof. Smith from Salem, N. J. An example taken in this vicinity is also in the collection of the late S. L. Elliot. The early stages are unknown. The caterpillar probably feeds on grasses.

Pamphila pontiac (*Edw.*).

PLATE VI, FIG. 14.

Butterfly.—Upperside deep brown, basal portion deep orange ochraceous, with a broad velvety black stigma, pinched at the middle; attached to the stigma is an orange ochraceous band; some distance above are three spots below the costa. Hind wings with an orange ochraceous, streak-like patch in the middle. Underside orange brown, with the band beyond the stigma broken into spots. Hind wings orange brown with the patch from above repeated. The female is wholly dark brown, with a curved band of spots beyond the middle. Hind wings like the male, also the underside of the wings, only somewhat darker. Expands 1⅜ to 1⅝ inches.

Not common in June and July. Taken on Staten Island, Lake Hopatcong, N. J., Snake Hill, N. J., West Farms, N. Y. City, and other places. Single brooded. The early stages are unknown.

Pamphila hianna (*Scud.*).

Butterfly.—Upperside wholly dark brown, somewhat paler outwardly, with one minute whitish dot beyond the end of the cell and a row of three anteapical spots below the costa above it. Underside with spots from above repeated, and along the outer margin is washed with grayish. Hind wings with the outer half scaled with gray. The female differs in having two spots at the end of the cell and one above the cell, and the three anteapical spots more distinct and whiter. The outer part of the fore wings with pale scales. Underside have the spots from above reproduced and the gray scales on both wings thicker and paler. **Expands 1⅛ to 1⅜ inches.**

A single specimen of this species has been taken by the late S. L. Elliot in the vicinity of New York City; also taken on Long Island. It appears in May and June, and is single brooded. The early stages are unknown.

Pamphila viator (*Edw.*).

PLATE V, FIG. 19.

Butterfly.—Upperside dark brown with an orange spot in the cell at the end, and a row of three rather large spots beyond and below, and two small spots below the costa before the apex. Hind wings with the brown margin broad, and the orange patch in the middle is broken by the veins. Underside of fore wings orange brown, blackish along the base to the hind angle. Spots from above repeated. Hind wings orange brown with the patch from above indistinct. Female similar to the male, but the spots are larger. **Expands 1¼ to 1⅜ inches.**

Scarce in this neighborhood. Taken in July on Snake Hill, N. J., Newark, N. J., and near Brooklyn, Long Island. Single brooded. The early stages are unknown.

Pyrgus montivagus *Reak.*

PLATE VI, FIG. 15.

Butterfly.—Upperside black with transverse rows of white spots of different sizes. Hind wings also with white spots. Underside whitish with the black from above partly repeated. Hind wings also whitish, with the bands more or less distinct and greenish. In the female the black markings are heavier. **Expands 1⅛ inches.**

Caterpillar.—Body naked, briefly pilose, green with a dark broken dorsal line, dark lateral band and a light band below the spiracles; thoracic shield black. Head piceous, summits rounded. Length, ⅔ inch.

Chrysalis.—Body slender, the abdomen longer than the rest of the body; posterior lip of thoracic spiracle elevated, flaring; yellowish white dotted above with black. **Length, ½ inch.**

***Food-plants.*—Mallow, *Althæa*, *Abutilon* and *Sida*.**

Taken on Staten Island in September, and recorded by Prof. Smith as being common throughout the State of New Jersey. To my knowledge it is very rare everywhere in this vicinity. Probably double brooded.

Pyrgus centaureæ (*Ramb.*).

Butterfly.—Differs from the preceding species by having only one row of white spots on the black fore wings; a spot at the end of the cell and one a little beyond. Hind wings with the two rows of white spots, not as large and distinct as in *P. montivagus.* Underside of fore wings greenish, with the greenish-white markings from above repeated and more distinct. Hind wings olivaceous with three rows of whitish spots across. Expands about 1¼ inches.

Exceedingly rare in this vicinity, and has been reported from Long Island. The caterpillar and chrysalis are unknown.

Pholisora catullus (*Fabr.*).

PLATE VI, FIG. 16.

Butterfly.—Upperside deep brownish black with an irregularly curved row of small white spots, and sometimes with traces of another row before the outer border, and one or two spots in the cell. Hind wings without markings, sometimes traces of an indistinct row of spots. Underside brown, but somewhat paler than above, with part of the white spots on the fore wings repeated. Expands 1 inch.

Caterpillar.—Body dull green, briefly pilose; thoracic shield velvety black, pale at the edges. Head black, summits rounded. Length, ⅞ inch.

Chrysalis.—Yellowish green with brownish dorsal line and similar ventral line on abdomen. Body slender, abdomen slender, longer than the rest of the body. Length, ½ inch.

Food-plants.—Chenopodium and *Amarantus.*

Very common everywhere in open fields and meadows. Double brooded. May to September.

Nisoniades brizo (*Bd.-Lec.*).

PLATE VI, FIG. 17.

Butterfly.—Upperside deep brown, darker towards the base, with an indistinct oblique, double, broken band before the middle of the wings, and another band, also broken, beyond the middle. The space between the first band contains a few grayish scales, and the space in the outer band thickly scaled with gray; also scaled with gray at the costa between the two bands and at the outer margin. Hind wings with two rows of indistinct pale spots near the outer border. Underside paler than above, with two rows of pale spots near the outer border. The two rows of spots on the hind wings distinct. Expands 1⅛ to 1½ inches.

Caterpillar.—Head dark brown, paler above, with an orange spot at base of mandibles. Body naked, briefly pilose, pale green with an indistinct paler lateral stripe and dotted with darker green. Length, over 1 inch.

Chrysalis.—Green, the appendages infuscated. Slender; abdomen longer than the rest of the body. Length, ½ inch.

Food-plant.—Oak.

Found in May and June in moist shady woods and along wood paths. The butterfly flies swiftly and near the ground. Single brooded.

Nisoniades icelus *Lintner.*

Butterfly.—Similar to *N. brizo* but smaller, and has the grayish scales more regularly distributed over the wings, but most distinct at the costa between the two transverse bands. The markings are like those of *brizo*, but with an additional more or less distinct line before the outer border. Underside similar to *N. brizo.* Expands 1 to 1⅜ inches.

Caterpillar.—Head light reddish brown, with slightly raised summits. Body naked, pilose, pale green dotted with white, giving a grayish green appearance, and with a pallid lateral stripe. Length, about ¾ inch.

Chrysalis.—Fore part of body reddish or yellowish brown, the abdomen pale flesh-color, the rest as in the other species. Length, ½ inch.

Food-plants.—Aspen, Willow and Witch-hazel.

Not rare in this vicinity in May and June in open woods, and especially along wood roads. Taken at West Farms, N. Y. City, Tuckahoe and Staten Island, N. Y.; Plainfield and Fort Lee, N. J., and other places. Single brooded.

Nisoniades lucilius *Lintner.*

Butterfly.—Upperside deep brown, becoming lighter towards the outer border; before the middle is an indistinct oblique transverse band almost obscured by the ground color, and another spot-like band beyond the middle, which contains a row of four minute semitranslucent spots beneath the costa and one or two spots about the middle. Sometimes there is a similar spot at the end of the cell. Over the outer part of the wing are scattered a few grayish scales. Hind wings with two rows of indistinct spots. Underside paler than above, with the spots repeated, and two rows of whitish spots before the outer border. Hind wings with the spots more distinct than above. Expands 1 to 1¼ inches.

Caterpillar.—Body naked, sparsely pilose, green, with a narrow pale yellowish lateral line. Head with the summits much elevated, black, with three reddish spots and streaks at the sides. Length, ⅘ inch.

Chrysalis.—Pale green. Slender, the abdomen longer than the rest of the body ; the posterior lip of the thoracic spiracle scarcely raised, not flaring ; the tongue-case scarcely extending beyond the wings. Length, about ½ inch.

Food-plants.—Wild Columbine (*Aquilegia*) and *Chenopodium.*

Rare in this neighborhood. Taken at West Farms, N. Y. City, by Mr. J. Angus, and in the Orange Mountains, N. J., by Dr. R. E. Kunze. May–June.

Nisoniades persius *Scudder.*

Butterfly.—Allied to *N. lucilius*, but larger and deeper in color, with the markings less distinct ; in some specimens the markings are almost obscured by the ground color. The white spots smaller than in *N. lucilius.* The female is almost identical, and is not readily separated except in size. Expands 1½ inches.

Caterpillar.—Body naked, scarcely pilose, pale green with pale yellowish lateral lines and sprinkled profusely with white dots. Head ferruginous, with pale vertical streaks or piceous marked with ferruginous. Length, about 1 inch.

Chrysalis.—Dull olivaceous green, much infuscated, abdomen pinkish brown, mottled faintly with pale dots. Length, about ½ inch.

Food-plants.—Willow and Poplar.

Not rare in this neighborhood, being found in different places in New Jersey, Westchester Co., Long Island and Staten Island. May–June. It occurs in woods and along shady road-sides. Single brooded.

Nisoniades martialis *Scudder.*

PLATE VI, FIG. 18.

Butterfly.—Upperside dark brown with a darker brown spot near the base of the cell ; then a distinct curved spot-like band, and another beyond the middle of the wing, followed by lilac-gray scales. Some specimens have more or less gray scales between the bands. On the outer band are four white spots in a row below the costa, and one about the middle of the band. Hind wings with traces of spots. Underside lighter with the white spots repeated, and two indistinct rows of pale spots near the outer margin. Hind wings with two rows of light spots. The female differs in having the bands more distinct and the ground color paler. Expands 1⅛ inches.

Caterpillar.—Body pale pea green with probably a darker dorsal stripe, greenish yellow lateral band and a stigmatal band; between the bands are white blotches. Head dark brown, each side with an upper and lower dull yellow, oval spot. Length, about 1 inch.

Chrysalis.—Pea green with obscure whitish dashes, paler on the abdomen. Cremasters orange yellow; thoracic spiracle black. Length, about ½ inch.

Rare in this vicinity, and found in similar localities as the other species of *Nisoniades*, in May and June, and again in July and August. Double brooded. It may be easily recognized by its conspicuous bands and spot at the base of the cell on the fore wings, especially in the female. The food-plants are said to be 'Red-shank' or 'Red-root' and Wild Indigo (*Indigofera carolina*).

Nisoniades juvenalis (*Bd.-Lec.*).

PLATE VI, FIG. 19.

Butterfly.—Allied to *N. martialis*, but is a much larger insect. The blackish bands are similar to those of *martialis*. The outer band contains a row of four spots below the costa, and one or two more about the middle, and one at the end of the cell. These spots are semitransparent, and are larger and more conspicuous than in any of the other species of *Nisoniades*. Underside with the spots repeated; otherwise much the same as *martialis*. Expands 1⅜ to 1¾ inches.

Caterpillar.—Body naked, sparsely pilose, light or dark green, with narrow pale yellow lateral lines, and much dotted with pale yellow. Head varying from greenish brown to fawn color, and heavily marked with pale orange at the sides. Length, 1 inch.

Chrysalis.—Pale or livid above, the abdomen faintly tinged with salmon above and below; metathorax slightly infuscated; all the appendages black or blackish brown; disc of wings dark olivaceous brown. Length, about ½ inch.

Food-plants.—Oak, Wild Bean (*Apios*) and other Leguminous plants.

Found from May to September, in woods, and is double brooded.

Eudamus tityrus (*Fabr.*).

PLATE V, FIG. 17.

Butterfly.—Upperside dark chocolate brown with a broad, oblique amber-yellow patch composed of four spots, running from the costa before the middle towards the hind angle, with a small spot outside of this band and three minute dots before the apex. Hind wings without markings. Underside with a gray bloom before the outer margins, and the markings of the fore wings repeated. Hind wings with a silvery white patch in the middle. Expands 2 to 2½ inches.

Caterpillar.—Naked, sparsely pilose, yellowish green, with green transverse lines encircling the body above, and blotches of the same color. First segment orange with a brown shield. Head ferruginous with an orange spot at the base of the mandibles. Length, about 1½ inches.

Chrysalis.—Dark brown. Stout and plump ; abdomen about as long as the rest of the body ; prothoracic spiracle with posterior lip flat ; tongue-case not extending beyond the wings. Length, about 1 inch.

Food-plants.— Locust, *Acacia*, *Amorpho fruticosa*, *Wistaria*, *Lespedeza*, *Desmodium*, Wild Bean, etc.

Common everywhere in this district, and is found in gardens and copses. The caterpillar lives in a nest made of a few leaves spun together with silken threads. Double brooded. May to August inclusive.

Eudamus pylades *Scud.*

Butterfly.—Upperside dark glistening brown, with a few very small white spots on the fore wings ; two or three on the costa at the middle ; three in a triangle beyond the middle of the wing, and three in a row on the costa before the apex. Hind wings without markings. Underside as above, but with grayish clouds before the outer margin, and the spots repeated. Hind wings beneath with two obscure bands, and also with grayish scales before the outer margin. Expands 1¼ to 1¾ inches.

Caterpillar.—Dark green, with a narrow dorsal stripe, a dull salmon lateral stripe, and the fold beneath the spiracles pale salmon. First segment black, edged with orange or red in front. Over the body are also minute black points and salmon-colored warts. Head black, covered with short whitish hairs. Length, about 1¼ inches.

Chrysalis.—Rather slender-bodied, the abdomen shorter than the rest of the body ; the prothoracic spiracle with elevated posterior lip ; tongue-case not extending beyond the wings; light brown, speckled with blackish brown, becoming blackish transverse broken bands on the abdomen. Length, ¾ inch.

Food-plants.—Clover and *Lespedeza.*

Common in open woods, fields and meadows; it flies rapidly, close to the ground, and is single brooded. Found from the latter part of May to the middle of August.

Eudamus bathyllus (*Abb. & Sm.*).

PLATE V, FIG. 15.

Butterfly.—Closely allied to the preceding species, but differs from it in having the spots on the fore wings much larger and very conspicuous; otherwise much the same as *E. pylades.* Expands 1¼ to 1¾ inches.

Caterpillar.—Dull mahogany brown, tinged with olivaceous and thickly sprinkled with dirty, pallid wartlets, each giving rise to a minute hair. There is a very faint, narrow dorsal line and an indistinct line beneath the spiracles. On the first segment is a dull black shield, and the soft integument before and behind it, pale, with no traces of any bright tint. Head black, minutely scabrous, covered with a dense pile of golden brown hair; neck black. Length, about 1 inch.

Chrysalis.—Dull greenish brown; the eyes and appendages with the posterior edges of the abdominal segments and the veins of the wings marked with fuscous brown; a few dots of the same color along the posterior margin of the wing-cases. Length, about ¾ inch.

Food-plants.—*Lespedeza*, Wild Bean, Butterfly-pea (*Centrosema virginianum*) and *Tephrosia.*

Found during June and July in the same places as *E. pylades*, in various localities in this vicinity, but is less common. Single brooded. It is more common southward. The caterpillar differs from *E. pylades* in the generally darker color and in the color of the soft integument of the first segment, and appears more scabrous.

Eudamus lycidas (*Abb. & Sm.*).

PLATE V, FIG. 16.

Butterfly.—Upperside very similar to *E. tityrus*, but there is an additional spot attached to the outside of the amber-yellow patch. The anal angle of the hind wings is also less produced. Underside of fore wings smeared with lighter brown, with the markings from above repeated. Hind wings with the outer portion smeared with white, and about the middle of the wing a large blackish patch containing a lighter spot ; other parts chocolate brown with darker streaks. Expands about 1¾ inches.

Caterpillar.—Body dark green, with a bluish green broad dorsal line, and heavily sprinkled with orange-yellow dots and black specks ; sides with two lateral yellow stripes ; thoracic shield black ; front edge of first segment blood red. Length, about 1½ inches.

Chrysalis.—Anterior part whitish brown, darker towards the head. Abdomen sordid yellow brown. Head with minute papillæ clustered into black patches ; similar papillæ are scattered over the thorax and abdomen, where they are in regular transverse lines. Length, nearly 1 inch.

Food-plants.—Desmodium and other Leguminosæ.

Not common in June and July in open places and edges of woods. The flight of the butterfly is swift, and it darts off very rapidly when disturbed. Besides alighting on flowers, it has the habit of sitting on the tips of dead branches of bushes and young trees. Single brooded.

Eudamus cellus (*Bd.-Lec.*).

PLATE V, FIG. 18.

Butterfly.—Blackish brown, with a broad, continuous, amber-yellow band running obliquely across the fore wings, from about the middle of the costa to nearly the hind angle ; before the apex is a row of three or four small, connected spots, and a minute one beneath this row. Hind wings blackish brown, with apex marked with a little yellow. Underside of fore wings marked with lighter brown, the band and spots from above repeated, and before the outer border a grayish line. Hind wings with three very indistinct dark brown transverse bands, and broadly overlaid with bluish scales along the outer border. Expands 1¾ to 2 inches.

Caterpillar.—Head black, with an orange spot at the base of the mandibles, and a large lavender spot in front. Body green, with a narrow darker dorsal line and a pale, broad stigmatal stripe, above which the sides are obscured with darker green ; thoracic shield black, and the anterior edge of the segment yellow. Length, 1½ inches.

Chrysalis.—Uniformly pale yellowish brown, with the incisures dusky. Length, 1 inch.

Food-plants.—Convolvulaceæ.

Exceedingly rare in this neighborhood ; it has been taken in the vicinity of Newark, N. J., as is recorded by Prof. Smith. It is more common in the Southern States, and is also found in Mexico.

Eudamus proteus (*Linn.*).

Butterfly.—Easily recognized by the long tail-like appendage on each of the hind wings. The wings and body are thickly covered with green hairs ; the fore wings have an oblique row of whitish spots, one spot beyond this row and a short row of smaller spots before the apex. Underside of fore wings paler brown, with the spots repeated. Hind wings with two transverse darker brown bands and two blackish spots below the costa about the middle of the wing ; tails deep brown. Expands about 2 inches.

Caterpillar.—Head large, round, brown, pubescent, with a yellow spot on each side of the mouth narrowing upwards and fading into the light brown of the upper part of the face. Body with a fine, dark dorsal line, a bright yellow subdorsal band and a pale green line along the base of the body ; dorsal space between the bands gray, dotted with black and yellow arranged in transverse lines ; sides gray, with the upper half dotted with black ; collar black, shining ; anal plate yellow, greenish in the middle. Underside of body pale green ; legs black ; prolegs yellow. Length, 1½ inches.

Chrysalis.—Dark brown when dried, fusco-luteous beneath, above mahogany colored, more or less tinged with luteo-olivaceous, shining throughout ; hairs of head as well as the scant hairs of the rest of the body luteous, the bristles of the prothoracic spiracles luteo-fuliginous ; the posterior lip of spiracle itself piceous ; mesothorax faintly striated in irregular, transverse wavy lines. Abdominal segments sparsely, irregularly and finely punctate, fuscous ; cremasters dark fusco-castaneous. Length, nearly 1 inch.

Food-plants.—Wild Bean (*Phaseolus*), Butterfly Pea (*Clitoria*), *Wisteria*, *Desmodium* and other allied plants.

Exceedingly rare in this neighborhood, but very common in the Southern States. It was taken by the late S. L. Elliot in Central Park, New York City, and is recorded by Prof. J. B. Smith as being taken at Newark and Cape May, N. J.

Synopsis of the Species of Hesperidæ.[1]

Ancyloxypha.

- Fore wings blackish washed with orange ochraceous.
  - Hind wings beneath clear orange ochraceous. .... *A. numitor.*

Pamphila.

- With a short black bar at end of discal cell in fore wings.
  - Hind wings beneath with a large yellow patch in the middle. . . *P. zabulon.*
  - Hind wings beneath clear yellow. .... *P. logan.*
- With an oblique velvety black stigma on fore wings (male).
  - Hind wings beneath yellowish, with an indistinct spot-like band in the middle. .... *P. sassacus.*
  - Hind wings beneath rusty brown, with a conspicuous row of white or pale yellow spots .. .. *P. leonardus.*
  - Hind wings beneath yellowish, with black spots. .... *P. phylæus.*
  - Hind wings beneath with a distinct, yellow, large spot-like band across the middle connected with a patch at the base. ..... *P. peckius.*
  - Hind wings beneath with a more or less distinct, yellow, spot-like band in middle, not connected with the patch near base . . *P. mystic.*
  - Hind wings beneath thickly scaled with olivaceous. .... *P. cernes.*
- Fore wings with stigma indistinct.
  - Hind wings beneath vinous, with a few very indistinct, paler spots in the middle. .... *P. verna.*
  - Hind wings lighter brown beneath than above. .... *P. metacomet.*
  - Hind wings beneath rusty brown, with violet patches. .... *P. accius.*
- With stigma on the fore wings curved.
  - Hind wings beneath dirty yellowish, with a lighter shade in the middle .... *P. huron.*
- Stigma and fore wings pinched in the middle.
  - Hind wings beneath orange brown, with a few yellow spots in the middle .... *P. pontiac.*
- With stigma connected with an indistinct, narrow basal streak.
  - Hind wings beneath ochraceous, with a row of lighter spots in the middle. .... *P. manataaqua.*
- Stigma broken in the middle.
  - Hind wings beneath rusty brown, with a row of lighter spots in the middle, or olive brown (var. *egeremet*). .... *P. otho.*
- Stigma absent.
  - Hind wings beneath with a large, bright yellow patch in the middle. .... *P. massasoit.*
  - Both sexes similar; hind wings beneath dirty yellowish brown, with a lighter spot-like patch in the middle. .... *P. viator.*
- Stigma minute, almost invisible.
  - Hind wings beneath washed with gray .... *P. kianna.*
- Fore wings deep brown, with bronzy lustre and two semitransparent spots in the middle.
  - Hind wings beneath paler than above, with a lighter reflection. . . *P. ocola.*

Pyrgus.

- Black, with transverse rows of white spots on the fore wings. . . *P. montivagus.*
- Black, with one row of transverse, white spots. .... *P. centaureæ.*

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[1] It is very difficult to give a satisfactory synopsis of the genus *Pamphila*, as the sexes of each species differ in markings on the upperside, especially on the fore wings. The males of some species are provided with a stigma, which is more or less distinct or wanting entirely; while in the females it is always absent. The markings and coloration of the underside of the hind wings, however, are constant in both sexes, and by means of this they may be readily united, or the species separated.

Pholisora.

Sooty black, with an irregular curved row of small white dots...... *P. catullus.*

Nisoniades.

Deep brown, fore wings thickly scaled with gray between the outer bands...*N. brizo.*
Smaller, with the scales more regularly distributed over the fore wings ....*N. icelus.*
Small, with white spots on the outer band ....*N. lucilius.*
Larger, marked like *lucilius* but less distinctly...................*N. persius.*
With bands on fore wings heavy and very conspicuous, white spots very indistinct.......................................*N. martialis.*
Large species, allied to *martialis*, but with heavy white spots....*N. juvenalis.*

Eudamus.

Chocolate brown, with an amber-yellow patch on fore wing.
  Hind wings with a large silvery-white spot in the middle.......*E. tityrus.*
  Hind wings beneath broadly smeared with white along the outer border ....*E. lycidas.*
Hind wings beneath with two transverse bands.
  Fore wings with small white spots.............................*E. pylades.*
  Fore wings with large white spots...........................*E. bathyllus.*
Fore wings with a broad, oblique, amber-yellow band.
  Outer border of hind wings scaled with gray....................*E. cellus.*
Hind wings with long, tail-like appendages.
  Wings and body above with long green hairs....................*E. proteus.*

The following list of species may possibly occur within fifty miles of New York City; but at present we have no record of their capture.

Phyciodes batesii Reak.—Recorded from Long Island and New Jersey.

Thecla læta Edw.—Taken at Atlantic City, N. J.

Thecla halesus Cram.—Taken at Cape May and Gloucester, near Westville, N. J. Common in the South.

Thecla m-album Bd.-Lec.—Recorded from Cape May, N. J. Common in the Southern States.

Calephelis borealis G. & R.—Recorded from New York and New Jersey.

Pamphila metea Scud.—Recorded from Farmington, New Britain, Conn., and the Schooley Mountains, N. J.

Pamphila seminole Scud.—Recorded from New Jersey, but without definite locality.

Pamphila maculata Edw.—Recorded from New York. Common in the Gulf States.

Pamphila panoquin Scud.—Has been taken in abundance at Atlantic City, N. J., in June and July. Common in the South.

Pamphila bimaculata G. & R.—Recorded from Albany, N. Y., and doubtfully from New Jersey.

Pamphila ethlius Cram.—Dr. S. H. Scudder records this insect as having once been taken at West Farms, New York City, by Mr. J. Angus. It has also been taken near Albany, N. Y., and its occurrence here is probably only accidental.

Pamphila fusca G. & R.—A single example of this southern species was taken by me at Sandy Hook, N. J.

Amblyscirtes vialis Edw.—Recorded as being locally common throughout the State of New Jersey, but without definite locality.

EXPLANATION OF PLATES.

PLATE II.

[The detached figures on the right hand side represent the undersides of the wings.]

Fig. 1.—*Papilio asterias* Fabr. Male.
Fig. 2.— " *turnus* Linn. Male.
Fig. 3.—*Pieris rapæ* (Linn.). Male.
Fig. 4.— " *protodice* (Bd.-Lec.). Female.
Fig. 5.—*Anthocharis genutia* (Fabr.). Male.
Fig. 6.—*Colias philodice* (Godt.). Female.
Fig. 7.—*Terias lisa* (Bd.-Lec.). Male.
Fig. 8.— " *nicippi* (Cram.). Male.

PLATE III.

The detached figures on the right hand side represent the undersides of the wings.]

Fig. 1.—*Danais archippus* (Fabr.). Male.
Fig. 2.—*Argynnis idalia* (Dru.). Male.
Fig. 3.— " *cybele* (Fabr.). Female.
Fig. 4.—*Euptoieta claudia* (Cram.). Male.
Fig. 5.—*Limenitis disippus* (Godt.). Male.

PLATE IV.

[The detached figures on the right hand side represent the undersides of the wings.]

Fig. 1.—*Argynnis myrina* (Cram.). Male.
Fig. 2.—*Melitæa phaëton* (Dru.). Male.
Fig. 3.—*Phyciodes tharos* (Dru.). Male.
Fig. 4.— " *nycteis* (Db.-Hew.). Female.
Fig. 5.—*Vanessa milbertii* (Godt.). Male.
Fig. 6.—*Grapta comma* (Harr.). Male.
Fig. 7.—*Pyrameis cardui* (Linn.).
Fig. 8.—*Junonia cœnia* (Hüb.). Male.
Fig. 9.—*Debis portlandia* (Fabr.). Female.
Fig. 10.—*Satyrus alope* (Fabr.). Female.

PLATE V.

[The detached figures on the right hand side represent the undersides of the wings.]

Fig. 1.—*Neonympha eurytris* (Fabr.). Female.
Fig. 2.—*Libythea bachmani* (Kirtl.). Female.
Fig. 3.—*Thecla melinus* (Hüb.). Male.
Fig. 4.— " *calanus* (Hüb.). Male.
Fig. 5.— " *damon* (Cram.). Female.
Fig. 6.— " *irus* (Godt.). Female.
Fig. 7.— " *niphon* (Bd.-Lec.). Female.
Fig. 8.— " *titus* (Fabr.). Male.
Fig. 9.—*Feniseca tarquinius* (Fabr.). Female.
Fig. 10.—*Chrysophanus thoë* (Bd.-Lec.). Male.
Fig. 11.— " *hypophlæas* (Bd.). Female.
Fig. 12.—*Lycæna scudderii* Edw. Female.
Fig. 13.— " *comyntas* (Godt.). Male.
Fig. 14.— " *pseudargiolus* (Bd.-Lec.). Female.
Fig. 15.—*Eudamus pylades* (Scud.). Male.
Fig. 16.— " *lycidas* (Abb. & Sm.). Female.
Fig. 17.— " *tityrus* (Fabr.). Female.
Fig. 18.— " *cellus* (Bd.-Lec.). Male.
Fig. 19.—*Pamphila viator* Edw. Female.

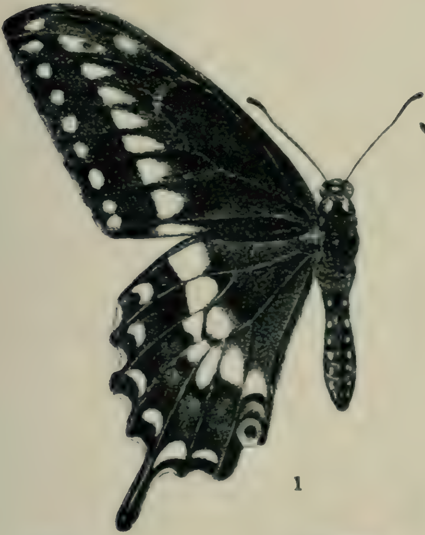
PLATE VI.

[The detached figures on the right hand side represent the undersides of the wings. Those marked "*a*" are the uppersides of the females.]

Fig. 1. —*Pamphila zabulon*, var. *hobomok* (Harr.). Male.
Fig. 1*a*.— " " " " Female.
Fig. 2. — " *massasoit* (Harr.). Female.
Fig. 3. — " *sassacus* (Harr.). Male.
Fig. 3*a*.— " " " Female.

Plate VI—*Continued.*

Fig. 4. —*Pamphila logan* (Edw.). Male.
Fig. 5. — " *leonardus* (Harr.). Male.
Fig. 6. — " *huron* (Edw.). Male.
Fig. 6*a*.— " " " Female.
Fig. 7. — " *phylæus* (Dru.). Male.
Fig. 8. — " *otho* (Abb. & Sm.). Male.
Fig. 8*a*.— " " " Female.
Fig. 9. — " *peckius* (Kby.). Male.
Fig. 9*a*.— " " " Female.
Fig. 10. — " *mystic* (Edw.). Male.
Fig. 10*a*.— " " " Female.
Fig. 11. — " *cernes* (Bd.-Lec.), Male.
Fig. 11*a*.— " " " Female.
Fig. 12. — " *verna* Edw. Male.
Fig. 13. — " *metacomet* (Harr.). Male.
Fig. 14. — " *pontiac* (Edw.). Male.
Fig. 14*a*.— " " " Female.
Fig. 15. —*Pyrgus montivagus* Reak. Male.
Fig. 16. —*Pholisora catullus* (Fabr). Male.
Fig. 17. —*Nisoniades brizo* (Bd.-Lec.). Female.
Fig. 18. — " *martialis* Scud. Female.
Fig. 19. — " *juvenalis* (Fabr.). Female.
Fig. 20. —*Ancyloxypha numitor* (Fabr.).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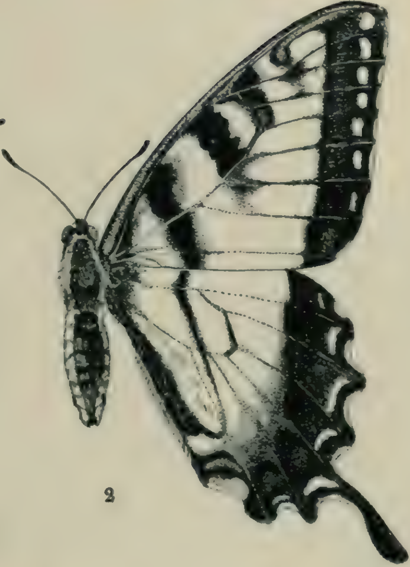
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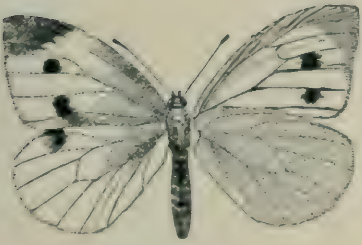
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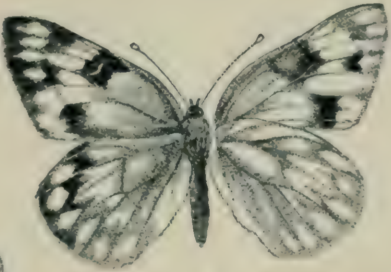
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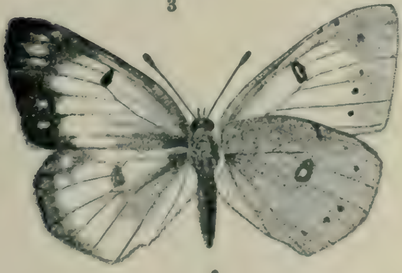
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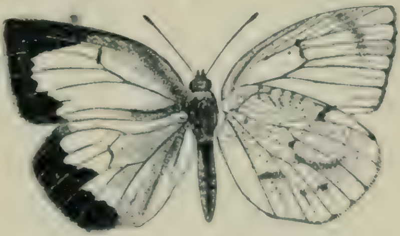
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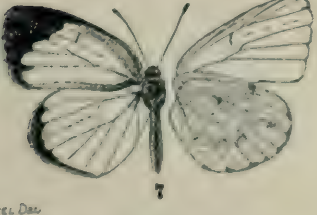
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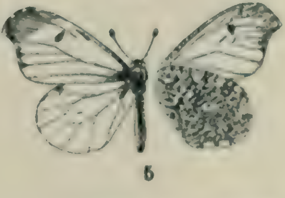
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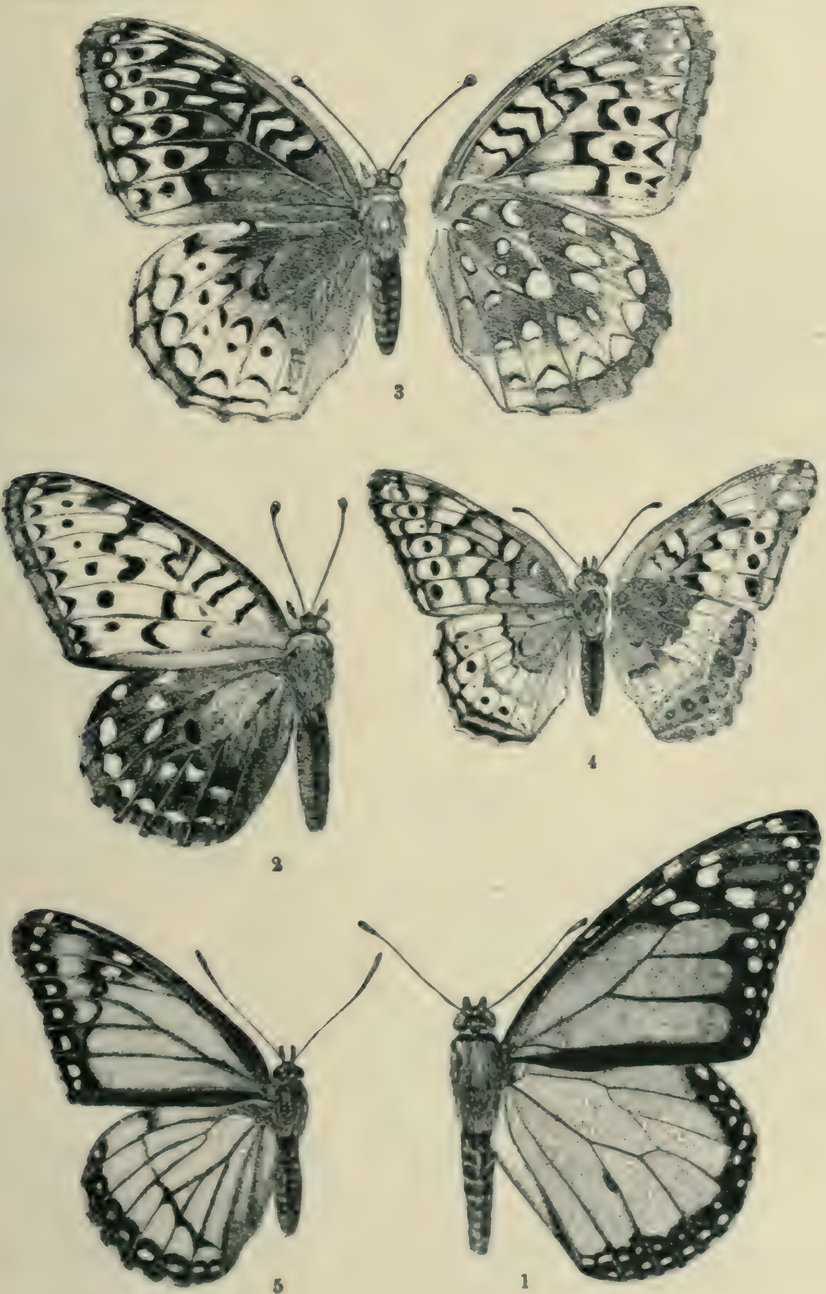
1. Papilio asterias Fabr.
2. " turnus Linn.
3. Pieris rapæ (Linn.)
4. " protodice (Bd. Lec.).
5. Anthocharis genutia (Fabr.).
6. Colias philodice (Godt.).
7. Terias lisa (Bd. Lec.).
8. " nicippi (Cram.).



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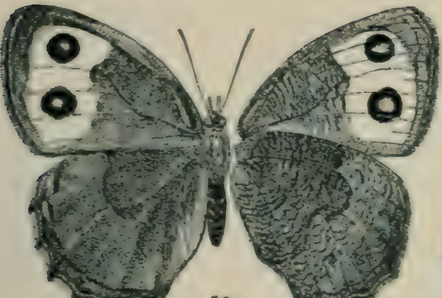
1. Danais archippus (Fabr.).
2. Argynnis idalia (Dru.).
3. Argynnis cybele (Fabr.).
4. Euptoieta claudia (Cram.).
5. Limenitis disippus (Godt.).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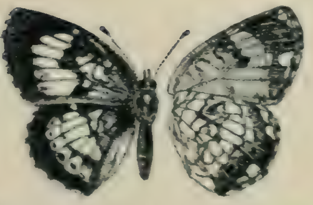
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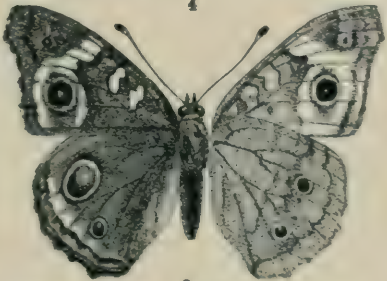
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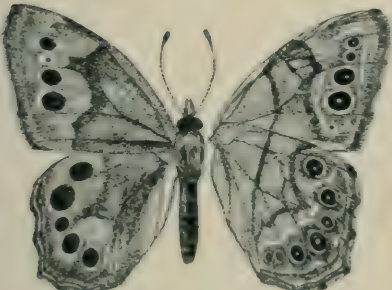
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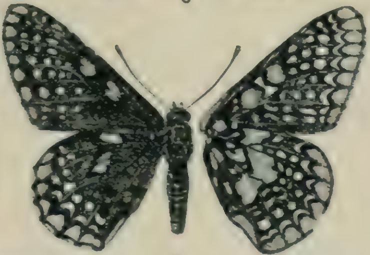
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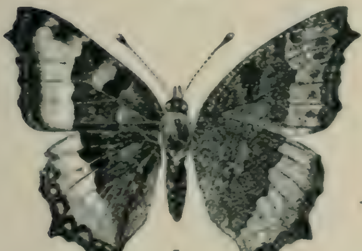
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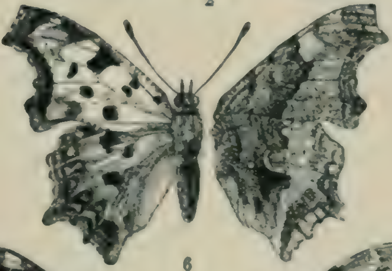
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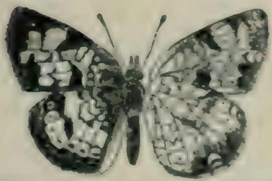
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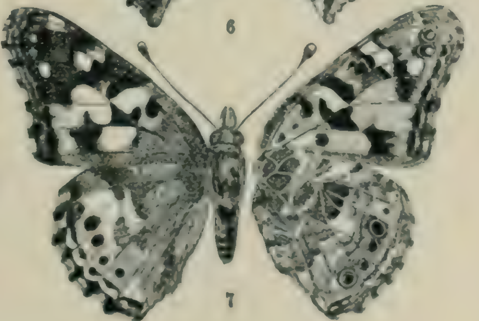
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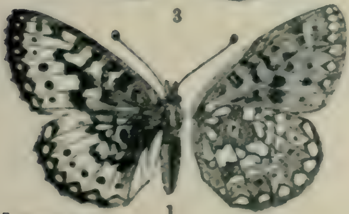
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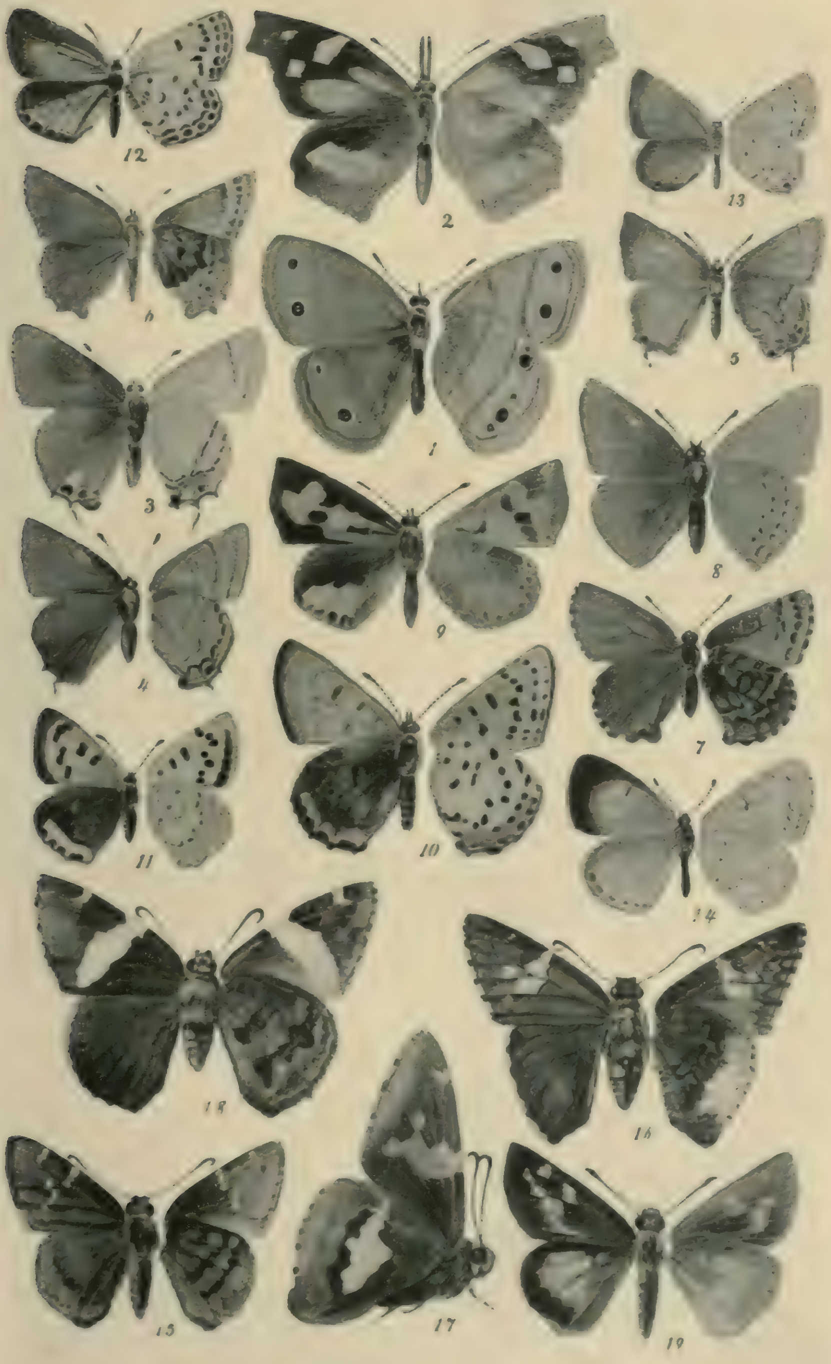
L. Joutel del.

1. Argynnis myrina (Cram.).
2. Melitæa phaëton (Dru.).
3. Phyciodes tharos (Dru.).
4. " nycteis (Dbl. & Hew.).
5. Vanessa milbertii (Godt.).
6. Grapta comma (Harr.).
7. Pyrameis cardui (Linn.).
8. Junonia cœnia (Hub.).
9. Debis portlandia (Fabr.).
10. Satyrus alope (Fabr.).

PLATE V.

[The detached figures on the right hand side represent the undersides of the wings.]

Fig. 1.—*Neonympha eurytris* (Fabr.). Female.
Fig. 2.—*Libythea bachmani* (Kirtl.). Female.
Fig. 3.—*Thecla melinus* (Hüb.). Male.
Fig. 4.— " *calanus* (Hüb.). Male.
Fig. 5.— " *damon* (Cram.). Female.
Fig. 6.— " *irus* (Godt.). Female.
Fig. 7.— " *niphon* (Bd.-Lec.). Female.
Fig. 8.— " *titus* (Fabr.). Male.
Fig. 9.—*Feniseca tarquinius* (Fabr.). Female.
Fig. 10.—*Chrysophanus thoë* (Bd.-Lec.). Male.
Fig. 11.— " *hypophlæas* (Bd.). Female.
Fig. 12.—*Lycæna scudderii* Edw. Female.
Fig. 13.— " *comyntas* (Godt.). Male.
Fig. 14.— " *pseudargiolus* (Bd.-Lec.). Female.
Fig. 15.—*Eudamus pylades* (Scud.). Male.
Fig. 16.— " *lycidas* (Abb. & Sm.). Female.
Fig. 17.— " *tityrus* (Fabr.). Female.
Fig. 18.— " *cellus* (Bd.-Lec.). Male.
Fig. 19.—*Pamphila viator* Edw. Female.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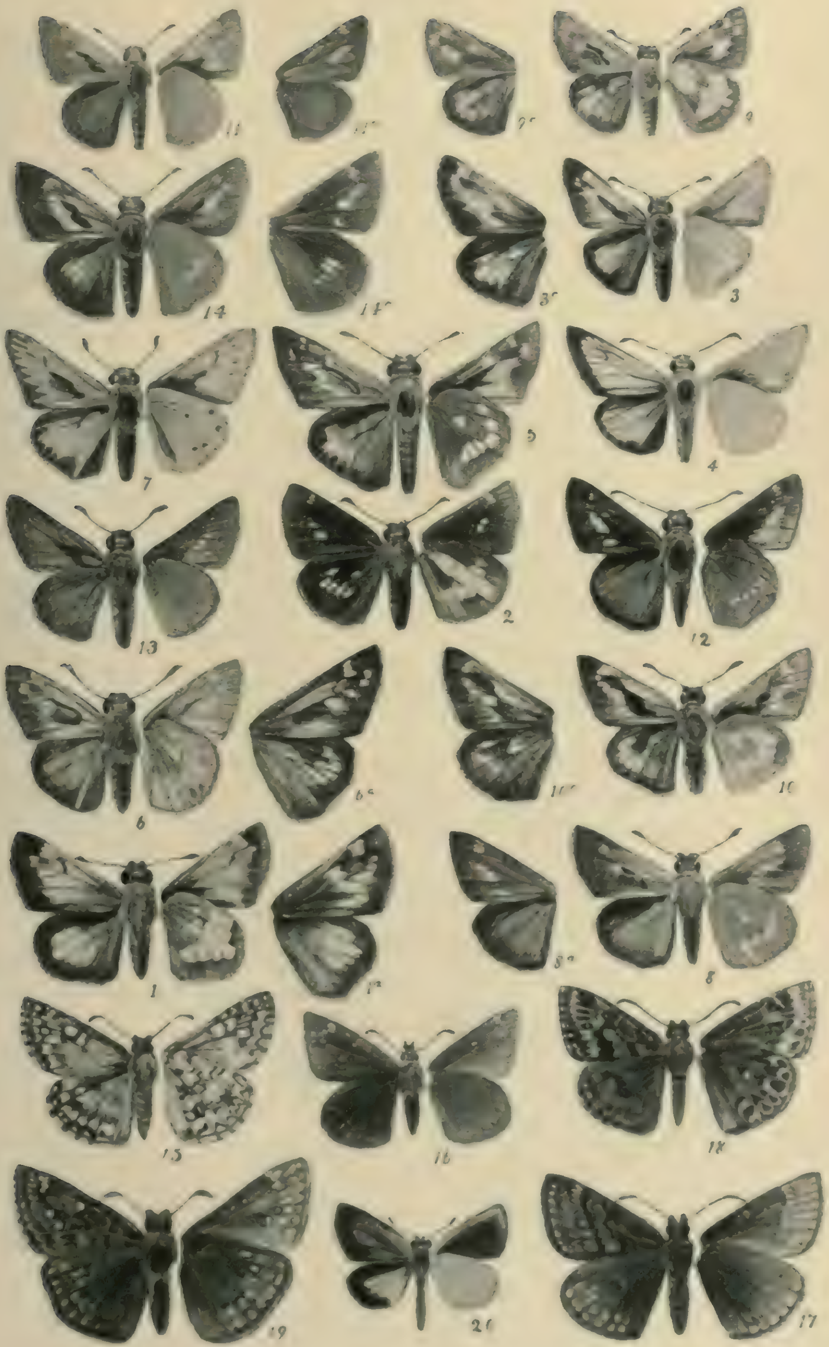
LITHOTYPE PRINTING CO., 111 NASSAU ST., N. Y.

Butterflies of the vicinity of New York.

Plate VI.

[The detached figures on the right hand side represent the undersides of the wings. Those marked "*a*" are the uppersides of the females.]

Fig. 1. —*Pamphila zabulon*, var. *hobomok* (Harr.). Male.
Fig. 1*a*.— " " " " Female.
Fig. 2. — " *massasoit* (Harr.). Female.
Fig. 3. — " *sassacus* (Harr.). Male.
Fig. 3*a*.— " " " Female.
Fig. 4. —*Pamphila logan* (Edw.). Male.
Fig. 5. — " *leonardus* (Harr.). Male.
Fig. 6. — " *huron* (Edw.). Male.
Fig. 6*a*.— " " " Female.
Fig. 7. — " *phylæus* (Dru.). Male.
Fig. 8. — " *otho* (Abb. & Sm.). Male.
Fig. 8*a*.— " " " Female.
Fig. 9. — " *peckius* (Kby.). Male.
Fig. 9*a*.— " " " Female.
Fig. 10. — " *mystic* (Edw.). Male.
Fig. 10*a*.— " " " Female.
Fig. 11. — " *cernes* (Bd.-Lec.), Male.
Fig. 11*a*.— " " " Female.
Fig. 12. — " *verna* Edw. Male.
Fig. 13. — " *metacomet* (Harr.). Male.
Fig. 14. — " *pontiac* (Edw.). Male.
Fig. 14*a*.— " " " Female.
Fig. 15. —*Pyrgus montivagus* Reak. Male.
Fig. 16. —*Pholisora catullus* (Fabr). Male.
Fig. 17. —*Nisoniades brizo* (Bd.-Lec.). Female.
Fig. 18. — " *martialis* Scud. Female.
Fig. 19. — " *juvenalis* (Fabr.). Female.
Fig. 20. —*Ancyloxypha numitor* (Fabr.).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LITHOTYPE PRINTING CO., 111 NASSAU ST., N. Y.

Butterflies of the vicinity of New York.

Article XVII. — FOSSIL MAMMALS OF THE UPPER CRETACEOUS BEDS.

By Henry Fairfield Osborn.

It is interesting to return to the study of the Cretaceous mammals, aided by a valuable collection of small isolated teeth and jaws, which the American Museum owes to the skill of Dr. Wortman and Mr. O. A. Peterson of the Expedition of 1892. This collection of about 400 specimens was made primarily with the object of completing the series of types of American fossil mammals, which has been undertaken for the Museum. It represents the great majority, but not all, of the types already described from the Laramie; it apparently adds a few new forms, and enables the writer to offer a further review of the Upper Cretaceous mammals thus far made known through the works of Cope, Marsh and Osborn.

The object of this paper is to show, as nearly as can be done at present, what these Cretaceous mammals were, by bringing the scattered teeth together and reconstructing the upper and lower dentition; and secondly, to consider how they are related in general structure, and in the stages of evolution which they represent, to the older Jurassic and more recent Puerco mammals from the basal Eocene. The main conclusions reached in these studies support and extend the opinions expressed by the writer in earlier papers, namely, that:

1. This Laramie fauna is widely separated from the Upper Jurassic, and is more nearly contemporaneous with the basal Eocene forms of the Puerco, and the Cernaysian of France.

2. It is not highly varied, but on the other hand rather limited in the number of distinct types represented, including only two, or possibly three, of the well-known types of Multituberculata (Allotheria) and several types of Trituberculates which can now be distinguished.

3. The Plagiaulacidæ are represented by species of the genus *Ptilodus* of Cope, which is very characteristic of the Puerco, and

of the genus *Meniscoëssus* of Cope, which is now found to be affiliated with *Polymastodon*, the great Plagiaulacid of the Puerco. The Bolodontidæ are also possibly represented by forms related to *Chirox* of the Puerco. In other words, the Multituberculates, which are distinctively a Mesozoic group, here exhibit their early Tertiary stage of development.

4. The Trituberculates prove to be considerably more varied, yet they exhibit an essentially Tertiary dental type. They apparently have the heterodont Eutherian dental formula ($p=4$, $m=3$), which is very exceptional in the Jurassic. They all present the *tritubercular* stage of tooth development in the upper molars, and the *tuberculo-sectorial* in the lower molars, stages which are also characteristic of the Puerco mammals. Among them also are forms resembling the smaller Creodonta and Condylarthra of the Puerco.

5. The association of the upper and lower, anterior and posterior, teeth has naturally resulted in a great reduction of the number of systematic terms proposed by Marsh with a corresponding gain in our knowledge of the structure of each form.

These conclusions are directly the reverse of those expressed by Marsh in his three papers upon this fauna. They are accordingly sustained in the somewhat detailed studies of the structure and systematic position of these forms which follow, and will be more fully discussed in the conclusion of this paper.

The systematic determination of these forms is attended with great difficulties. The teeth generally come in from the field entirely isolated, since they are found in the sand and among the ant hills completely washed out of the matrix. Rarely the teeth remain in the jaws. Fortunately the characters of the Multituberculate dentition are now well known to the writer through the study of all the collections in this country and abroad. These teeth have been brought together in the composition drawings of Plate VII with some degree of certainty. The association of the upper and lower, anterior and posterior, molars and premolars of the Trituberculates is a still more difficult matter, and has been attempted only in one or two cases. The apparently well-established name *Meniscoëssus* may be superseded by *Paronychodon lacustris*, a term founded by Cope in 1876[1] upon the tooth of a supposed reptile which appears to be identical with the large lower incisors of *Meniscoëssus*.

I.—THE MULTITUBERCULATES.

The two genera of Multituberculates which can now be fully distinguished and defined in their tooth structure are *Ptilodus* and *Meniscoëssus*. The former genus fits in its place as one of the long succession of Plagiaulacidæ, which began with the Rhætic *Microlestes*, and terminated with *Neoplagiaulax* of the Cernaysian. These species are fully as advanced in structure as those of the Puerco. *Meniscoëssus* also proves to belong to the same family, although it is somewhat exceptional in the sharply crescentic tubercles upon its upper and lower teeth. It is found to have a large cutting premolar (*p4*), and a rudiment of the third premolar (*p3*). A third genus is related either to *Bolodon* or to *Chirox*, presenting low-crowned teeth, surrounded by small conical cusps grooved upon their sides. These have been described under the name of *Allacodon* Marsh.

PLAGIAULACIDÆ *Gill.*

SYN.—*Cimolomidæ* Marsh, *Cimolodontidæ* Marsh, *Dipriodontidæ* Marsh, *Tripriodontidæ* Marsh.

The distinctive feature of this family is the cutting fourth lower premolar, opposed to a more or less trenchant upper fourth premolar. It is now well established that the lower molars have two rows of tubercles ; the upper molars have three.

In the Laramie representatives of this family there are two types which may be readily distinguished. All the small forms appear to belong to the genus *Ptilodus* (Fig. 1), and are readily distinguishable by conical tubercles upon the molar teeth, by premolars completely covered with very numerous (10 to 14) grooves and ridges on their sides, by smooth lower incisors in which the enamel is wanting upon the posterior and inner faces. All the larger forms belong to the genus *Meniscoëssus*, and are characterized by molars with crescentic tubercles, the direction of the crescents being reversed in the two jaws ; the premolars have deeper but less numerous grooves, and the lower incisors are grooved upon the sides and completely surrounded by enamel.

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[1] Proc. Acad. Nat. Sc. Phila., 1876, p. 256.

Ptilodus.	*Meniscoëssus.*
Lower incisors smooth, enamel wanting and dentine exposed posteriorly.	Lower incisors striated upon inner and outer surfaces, with complete investment of enamel.
Third premolars small and conical.	Third lower premolars small and conical. Fourth relatively smaller than in *Ptilodus*, with a few ridges (6 to 8).
Fourth premolars with numerous (12 to 14) fine grooves. Molars with conical or slightly crescentic tubercles.	Superior molars with strongly crescentic tubercles opening forwards. Inferior molars with crescentic tubercles opening backwards.

Genus **Ptilodus** *Cope.*

Plate VII, Figs. 1–6.

Syn.—*Cimolomys* Marsh, *Cimolodon* Marsh, *Nanomys* Marsh, *Halodon* Marsh, *Allacodon* Marsh (? in part).

This genus is represented by very numerous small isolated teeth of both the upper and lower jaws. As a rule the teeth are completely detached, but sometimes, as in the case of one or two of the molars and the fourth premolar, are found in place. The third lower premolar is so small as to have escaped the scrutiny of the collectors, but it is clearly represented by a distinct alveolus in the three lower jaws of this collection. The lower teeth correspond so closely in their general characters to those of *Ptilodus* that it is quite easy to place them in their proper position. We cannot be equally certain in regard to the upper teeth. The median pair of upper incisors and the minute second incisor are, nevertheless, found corresponding in proportion to these two teeth, as seen in a recently discovered specimen of *Polymastodon.* The fourth upper premolar is readily recognized by its substantial agreement in size with the fourth lower premolar. It is well distinguished, however, by a lower crown surmounted by a serrate or notched cutting edge, and an accessory row of tubercles.

We recall the fact that in the upper jaw of *Ctenacodon* Marsh, in front of the fourth cutting premolar, there are several low tubercular premolars, as figured by Marsh; similar teeth are found in these deposits and figured by Marsh under the name of *Allacodon;* it is possible either that they represent the anterior upper premolars of *Ptilodus* or *Meniscoëssus*, or that they belong to a distinct form similar to *Chirox*.

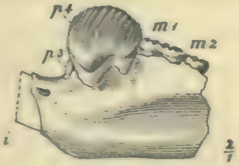

Fig. 1. Type of *Ptilodus trovessartianus* Cope, after original in Cope collection. Twice natural size.

There is considerable variation in the structure and number of tubercles in the upper and lower rows of the molars. These variations probably indicate different species, but it is almost impossible at the present time to use specific terms with any degree of certainty, for we have absolutely no means of placing any two of these teeth together. We will therefore describe the general characters of the upper and lower teeth.

Incisors.—The curved lower incisors have an oval section, flattened upon the inner side where they came in contact. The inner and part of the posterior surfaces are entirely devoid of enamel, which nevertheless covers the front and outer surfaces. They vary in size from extremely minute teeth to teeth three times as large. This variation probably represents the range of size among the species of *Ptilodus*, as we observe a similar wide variation in the fourth premolars (Fig. 2, *a–f*). The median upper incisors are short crowned and slightly notched at the back; they are closely applied with oblique posterior faces, in which the dentine is exposed, and which are therefore kept sharply worn by the lower teeth, as in the Rodents. There was undoubtedly a second upper incisor, but this has not yet been found.

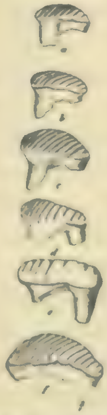

Fig. 2. Fourth inferior premolars of the Laramie *Ptilodus*, species indeterminate. Twice natural size.

Premolars.—The third lower premolars are minute simply conical or slightly compressed teeth (Pl. VII, Figs. 5–6). The fourth lower premolars (Fig. 2, *a–f*) have a large anterior and small posterior root (see figures of *Halodon serratus* Marsh, *H. formosus* Marsh). They are well distinguished by obliquely arching ridges and grooves, which completely cover the outer and inner surfaces, so that in the unworn teeth the upper border is serrate. The number of ridges varies in the smaller and larger forms from eleven to fourteen. The upper premolars (Pl. VII, Fig. 4) have less elevated crowns, with from six to seven notches upon the main internal crest, and from three to four basal tubercles upon the postero-external ridge. The inner side of these teeth is that which is most worn, indicating that the lower premolars wore against the slightly concave inner sides of the upper premolars. These upper premolars are found in sizes varying in proportion to the variations already observed in the incisors and lower premolars. There are indications of at least two species.

Molars.—The first and second lower molars (Pl. VII, Fig. 1) are sharply distinguished from each other by their length, the first molar being nearly twice as long as the second. The inner and outer sides are also readily recognized by the fact, as observed in *Ptilodus*, that the greater number of tubercles is upon the outer side, and the lesser number upon the inner side.

The first lower molar (type of *Cimolodon nitidus* Marsh) is very abundantly represented; eight or ten are found in this collection. The tubercles in the outer row vary from eight to six, and in the inner row from six to four; the first lower molar has an average of six tubercles in the outer row, and five in the inner row. The second lower molar (see also type of *Nanomys minutus* Marsh) is invariably characterized by two large tubercles in the inner row, and from six to seven very small tubercles in the outer row, which diminish as they extend around the posterior edge of the base of the crown. The form of this tooth is remarkably persistent, for it is substantially similar to the same tooth in the Jurassic *Plagiaulax*.

The first upper molar (Pl. VII, Figs. 3–4) has an elongate crown covered with three rows of conical tubercles (see also types of *Cimolomys gracilis* Marsh, *C. bellus* Marsh, *C. digona* Marsh). The formula of these tubercles is 8 in the middle row, and 8 and 6 respectively in the outer and inner rows; in some teeth there is the formula, 7, 7, 6, and in others it is 10, 10, 9. There are two types of these molars, one with the three rows of tubercles equally complete (type of *Cimolomys gracilis* Marsh), and a second type with one of the outer rows incomplete (type of *C. digona* Marsh); it is probable that these two types represent different species. The second upper molar has a formula of 5, 4, 3 in its three rows.

It is somewhat uncertain whether the upper molars follow the same laws as the lower; it is probable that in both upper and lower molars the greater number of tubercles is upon the outer side, as in *Polymastodon* and in *Chirox* of the Puerco.

It is very difficult to define the species, because they are all founded upon single teeth which we cannot at present associate. We may describe the larger type, *Ptilodus* (*Cimolomys*) *gracilis*, as characterized by three complete rows of tubercles in the first upper molar, formula 7, 8, 9; and the somewhat smaller types may be placed under *Ptilodus* (*Cimolomys*) *digona* with the inner row of tubercles extending only half the length of the crown; it should be said, however, that this molar is very similar to the second upper molar of *Chirox* Cope; and it is possible, therefore, that it should be associated not with *Ptilodus* but with *Allacodon* Marsh.

Genus **Meniscoëssus** *Cope.*

PLATE VII.

SYN.—*Dipriodon* Marsh, *Tripriodon* Marsh, *Selenacodon* Marsh, *Halodon* Marsh (in part), ? *Oracodon* Marsh.

This form is fully as abundant as *Ptilodus*, being represented in this collection by numerous teeth from both the upper and lower jaws. As in *Ptilodus* the third lower premolar is so small as to have escaped the scrutiny of the collectors, but it is represented by a distinct alveolus in the jaw. There is also considerable uncertainty as to the upper premolars; they are probably represented by such teeth as the types of *Oracodon* Marsh. The lower incisors are readily distinguished by their plano-convex surfaces, complete enamel, and the striations upon the sides. The upper and lower molars are readily distinguished by their large size and the very marked crescentic form of the tubercles. There can be no uncertainty in placing these teeth together, as done in Pl. VII, Figs. 7 and 8. The composition of upper and lower teeth represented in Fig. 9 is more or less conjectural.

Incisors.—(See *Halodon sculptus*, *Tripriodon caperatus*, *Halodon serratus* Marsh.) The lower incisors are striated both upon the inner and outer sides, and so flat upon the inner surfaces that it is apparent they were placed very closely together. The larger form and the smaller form indicates that there was great range of size variation in *Meniscoëssus*, the smallest forms being nearly of the same size as the largest forms of *Ptilodus*.

The medium upper incisors (Pl. VII, Fig. 9) are apparently smooth, or very slightly striated; they are notched at the extremity and have a very decided cusp on the posterior face, which apparently serves as a check for the lower teeth, and is so characteristic of all the Multituberculata. These upper incisors may be distinguished from those of *Ptilodus* by their complete investment of enamel, and by the much greater length of the enamel crowns; the *Ptilodus* upper incisors having short, obtuse crowns. The third lower premolar is represented in our collection by its alveolus in the jaw. The fourth lower premolar is readily distinguished from that of *Ptilodus* by the very decided character of its ridges and grooves, which are only from seven to eight in number. They terminate upon the anterior portion of the crown in a decided basal ridge, which is wanting in *Ptilodus*. Another feature is, that the ridges are less distinctly arched than in *Ptilodus*.

The first lower molar (type of *Dipriodon lunatus* Marsh) is a long, narrow tooth, which is very constant in the number of its tubercles; there are five tubercles in the outer and four in the inner row—this is sometimes reduced to four and three. The second lower molar (type of *Dipriodon robustus* Marsh) is equally constant, with four tubercles in the outer and two in the inner row; there sometimes being but three in the outer row. The two tubercles in the inner row indicate the relationship of this form to the true Plagiaulacidæ.

In the upper molars the first and second bear the same proportions as in *Ptilodus*. The formula of tubercles in the first upper molars (type of *Selenacodon fragilis* Marsh) varies from 6, 7, 5 to 8, 6, 6; while in the second upper molar it varies from

4, 3, 2 to 4, 4, 3. This comparison proves that the type of *Meniscoëssus conquistus* Cope was also a second molar (type of *Tripriodon cœlatus* Marsh), in which the formula is 4, 4, 4–2.

One of the most interesting features about these molars, and one which enables us to recognize them readily, is, that in the upper molars the crescents open forwards, while in the lower molars they open backwards. The crescents are thus reversed in the two jaws, forming a very effective grinding apparatus. This recalls the fact that the crescents are similarly reversed in the upper and lower jaws of the Ruminant Artiodactyla, although in this case they open respectively outwards and inwards, instead of forwards and backwards. In the type of *Stereognathus* Charlesworth, a form which still remains *incertæ sedis*, there are three rows of crescents opening forwards in what Owen described as a *lower jaw*. Marsh has suggested that this type may be an *upper jaw;* if this were the case it would conform with the cusp arrangement of *Meniscoëssus*.

No teeth are found which can with certainty be considered the upper promolars of *Meniscoëssus;* we naturally look for something similar to the upper premolars of *Ptilodus*, and we find it represented most nearly in the types of *Oracodon anceps* and *O. conulus* Marsh. Several similar teeth are represented in this collection, and they are distinguished from those of *Ptilodus* by tubercles upon both the inner and outer bases of the main ridge; these irregularly tubercular teeth very possibly represent the third and fourth upper premolars of *Meniscoëssus;* none have been found, however, in which the main shear is quite equal in size to the shear of the fourth lower premolar.

In earlier reviews of the dentition of *Meniscoëssus*, the writer was led to confuse the upper and lower molars by Prof. Marsh's description of *Meniscoëssus* (*Dipriodon*) *robustus* as a tooth with tubercles in two rows, which has a supposed zygomatic portion of the superior maxillary bone attached. This, together with the supposed lower jaw of *Stereognathus*, which has crescentic tubercles in three rows, led the writer to suppose that *Meniscoëssus* and *Stereognathus* together represented a family, Stereognathidæ, characterized by crescentic tubercles placed in three rows in the lower jaw and in two rows in the upper jaw. This proves to be an what older in type than the Puerco because they lack all traces of quadrituberculy.

Sexituberculy in the lower molars is the main type (see Pl. VIII, Figs. *A–Hl*), but there are some in which the antero-internal cusp (paraconid) is wanting, and others in which the talonid bears only one cusp instead of three. These lower teeth are of two types: first, the 'secodont' or tuberculo-sectorial, with an elevated anterior triangle (trigonid), and a low heel (talonid); second, the 'bunodont,' very similar to that of the small Eocene Primates; in this type the trigonid and talonid are on the same level. The heel usually consists of a broad basin with three well-developed cusps (hypoconid, hypoconulid and entoconid); this strong development of the talonid and depression of the anterior portions of the crown to the same level with the posterior portion affiliates these teeth with those of the Puerco in their general evolution.

Summary of Molar Characters.

Upper Molars.—*a.* Cusps of medium height, trigon not elevated as in the known Jarassic mammals.
b. Protocone, or main internal cusp, on or above the level of the external cusps (paracone and metacone), except in one type.
c. Intermediate tubercles wanting or feebly developed on the spurs of the protocone.
d. External cingulum usually well developed, with one or more supplementary cusps.
e. Internal cingulum entirely wanting, except in one type.
f. No trace of hypocone or postero-internal cusp.

Lower Molars.—*a.* Trigonid usually elevated; sometimes depressed to level of talonid.
b. Talonid, a broad basin usually bearing three distinct cusps (hypoconid, hypoconulid, entoconid).
c. Protocone, or antero-external cusp, invariably the most elevated.
d. Paraconid usually strong; depressed and degenerate in one type. Metaconid strong.

2.—ANALYSIS OF MARSH'S TYPES.

The second step is to examine the types figured by Marsh of the six genera of Trituberculates which he has proposed. For the sake of clearness his figures are here reproduced. The type of *Didelphops* (*Didelphodon*) *vorax* (Fig. 4, 2) is a low-crowned symmetrically tritubercular upper molar, with all three cusps on nearly the same level, and two small intermediate tubercles externally placed; there is a strong external cingulum notched in the median line. The type of *Cimolestes incisus* (Fig. 4, 14–15) is a lower tuberculo-sectorial molar, quite similar to a third lower molar of *Didelphys*. The type of *Pediomys elegans* (Fig. 4, 23–24) is an asymmetrical upper molar distinguished by a strong anterior spur on the external border; the intermediate tubercles are very small and internally placed. The type of *Stagodon nitor* (Fig. 4, 22–25) is characterized by Marsh by the resemblance of the crown to a drop of viscous fluid; the mammalian nature of the fossil is doubtful. The type of *Platacodon nanus* (Fig. 4, 4–6) is also of doubtful mammalian affinity. The type of *Telacodon lævis* (Fig. 4, 3) is a right lower jaw containing three premolars and three alveoli, which are believed by Marsh to have contained

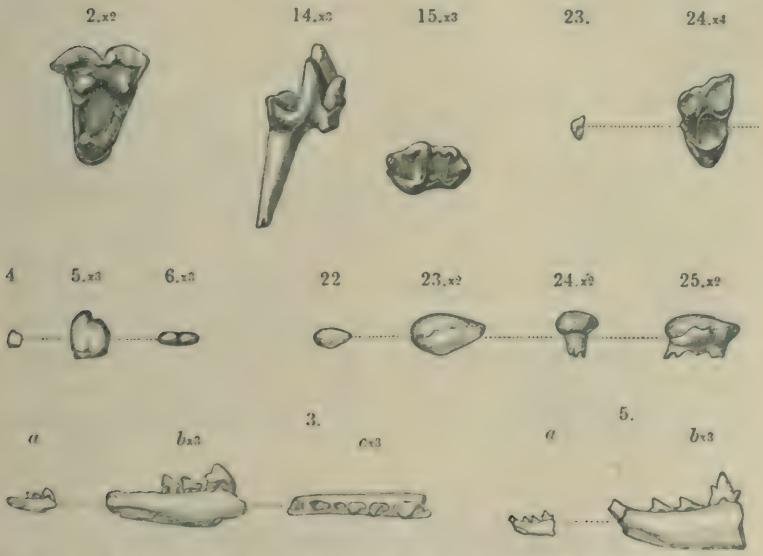

Fig. 4. Type specimens of genera proposed by Marsh. 2, *Didelphops vorax*. 14, 15, *Cimolestes incisus*. 23, 24. *Pediomys elegans*. 4, 5, 6. *Platacodon nanus*. 22–25, *Stagodon nitor*. 3, ***Telacodon lævis.*** 5, ***Batodon tenuis.*** Sizes as indicated.

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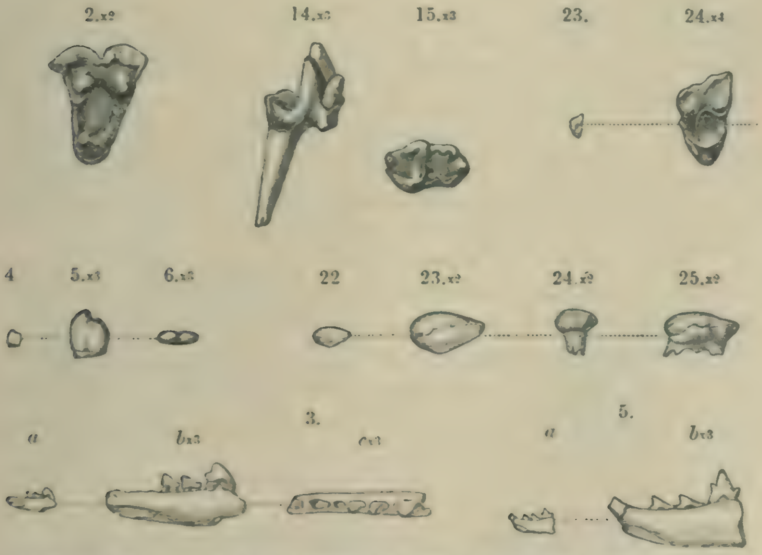

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two more premolars and a canine. The type of *Batodon tenius* (Fig. 4, 25) is also the anterior portion of a lower jaw containing three premolars and the alveolus of a fourth. It is evident that at present no characters can be assigned to separate the types of *Cimolestes* and of *Didelphops*, or to separate the types of *Batodon* and of *Telacodon* from that of *Pediomys*. A careful study of these generic types, together with the isolated upper and lower molars associated with them under a number of different specific names by Marsh, shows that *many teeth have been placed together which evidently do not belong together*, as in types of the various species of *Stagodon*, and that it is premature to attempt to associate many of the upper and lower teeth. *The dentition and taxonomy of these mammals cannot be definitely determined until we procure upper and lower jaws with the teeth in situ.* A step in this direction has recently been made by the discovery of Cope of a lower jaw, the type of *Thlæodon*, from another exposure of the Laramie.

The best course to pursue in order to advance our knowledge of the Cretaceous Trituberculates is to lay principal emphasis upon the *forms* of the upper and lower teeth, and avoid the proposal of new generic and specific terms which cannot be defined. The accompanying comparative figures (Pl. VIII) have been prepared in order to bring out the chief types of upper and lower molars.

3.—SUPERIOR AND INFERIOR DENTITION.

PLATE VIII.

We may pass from the most primitive to the most specialized types, taking the upper molars as a standard. *Primitive features* of the upper molars are: Symmetrical form of the trigon or main triangle of cones; large size of the internal cusp or protocone; symmetry of external cusps or paracone and metacone; feeble or non-development of conules; absence of cingulum; absence of external cingular cusps or styles (parastyle and metastyle). Primitive features of lower molars are: Elevation of the three main cusps or trigonid; narrowness of the heel or talonid; development of but a single cusp on the talonid.

Superior Molars.

A.—Crown triangular; flattened external border with an anterior cingulum bearing small cusps; main cones, *pr*, *pa*, *me*, subequal; conules, *pl*, small, close to protocone.

Genus **Pediomys** *Marsh.*

B.—Smaller; trigon similar to type *A;* external border with strong anterior cingular spur; conules intermediate in position, *pl*, *ml.*

C.—Trigon greatly compressed transversely; no external cingulum; cones, *pr*, *pa*, *me*, subequal. Apparently associated with the lower molar *Cl.*

D.—Trigon extended transversely; external border symmetrical, with fairly developed cingulum; internal cone, *pr*, and external cone, *pa* and *me*, separate; protocone prominent; conules small, externally placed.

Genus **Didelphops** *Marsh.*

E.—Trigon greatly extended transversely; external border symmetrical, with strong cingulum, and deep median notch; well-developed parastyle, *ps;* conules small, externally placed. This specimen is the type of *D. vorax* (after Marsh).

F.—Crown extended transversely; trigon proper compressed by approximation of external cones, *pa* and *me*, to protocone; external border broad, bilobate, with strong parastyle and metastyle, *ps* and *mts*, and small mesostyle.

Teeth of this type are mistakenly referred by Marsh to *Didelphops*, species *D. comptus.*

They are similar in type to the upper molars of *Ectoconus*, a member of the Puerco Periptychidæ.

G.—Trigon extended transversely; three external cusps in line; protocone depressed; ? paracone elevated; partial internal cingulum.

Upper molars of this type are doubtfully referred to *Batodon tenuis* by Marsh.

They are somewhat similar in type to *Dissacus*, a member of the Puerco Mesonychidæ.

Inferior Molars.

Al.—Trigon is less elevated; paraconid as lofty as protocone; talonid somewhat depressed with large hypoconid and entoconid and small hypoconulid.

These teeth agree in size with Type *A*, superior molar. They are more nearly of the bunodont type than any other teeth known from the Laramie.

Hl.—Protoconid and metaconid depressed; paraconid elevated; talonid rather narrow, with a single cusp.

Cl.—Trigonid and talonid greatly compressed transversely; sexicuspidate.

This transversely compressed crown is somewhat similar in type to *Haploconus xiphodon* Cope, also to *Zetodon*, another aberrant member of the Puerco Periptychidæ.

Genus **Cimolestes** Marsh.

Il.—Protoconid and metaconid elevated; paraconid extremely depressed; talonid supporting three cusps broader than trigonid.

The type of *Cimolestes incisus* Marsh, although larger than this tooth, has similar characters.

El—Trigonid elevated; protocone elevated above paraconid and metaconid; talonid broad.

The tooth corresponds in size with the type of *Didelphops vorax;* its association is uncertain.

It thus appears that there are six or seven quite distinct types of superior molars (*A–G*), and a similar number of inferior molar types. The upper and lower molars referred by Marsh to various species of *Pediomys*, *Didelphops*, *Cimolestes*, *Batodon* and *Telacodon* conform more or less closely to one or the other of these types; some of the lower molars figured by Marsh are even more strikingly bunodont than our type *Al*.

The premolars determined by Marsh as *Stagodon validus*, *tumidus* and *nitor* are as his terms indicate of a stout character, which we should expect to find associated with our Type *F*, superior molar. They are also somewhat similar to the premolars of some of the Periptychidæ, such as certain species of *Haploconus*, *Ectoconus* and *Periptychus*.

III.—FAUNAL RELATIONS OF THE LARAMIE MAMMALS.

The first question is one of age. These mammals are found in the Laramie, or uppermost of the six great divisions of the Cretaceous. Their exact stratigraphical position is in the middle or lower half of the Laramie Beds. Thus far they are only known to occur in the Wyoming exposures associated with remains of the large *Dinosaurians* such as *Agathaumus* (*Triceratops*), *Diclonius*, *Lælaps*. In New Mexico, as observed by Wortman, some of these Dinosaurs continue to the very top strata of the Laramie, which in turn are conformably overlaid by the basal Eocene or Puerco. Therefore the Puerco mammals, although they are separated by a considerable interval (of Upper Laramie) in which no mammals have been found, are still much nearer to these Laramie mammals than the latter are to the Middle Jurassic mammals of the Atlantosaurus Beds.

The second question is one of faunal relations. In his latest paper upon the Cretaceous Mammalia (March, 1892), Prof. Marsh draws two general conclusions as to the structure and relations of these mammals. First, as to their geological relations and age, he says:

"They are mainly Mesozoic in type, and more nearly related to the Jurassic forms below than to those in the Tertiary above.

....Bearing in mind all that is known to-day of the development and succession of vertebrate life in America, from the early Silurian on to the present time, it is safe to say that the faunal break as now known between the Laramie and Lower Wahsatch, is far more profound than would be the case if the entire Jurassic and the Cretaceous below the Laramie were wanting."

Second, as to the faunal relations of these mammals, he says :

"The geological lesson now taught by these mammalian relics and their associated vertebrate fossils is no less important, but hardly what was expected. These remains are not transitional between Mesozoic and Tertiary forms, but their affinities are with the former without a doubt ; thus indicating a great faunal break between the time in the Cretaceous when they lived, and the earliest known Tertiary, or between the Ceratops horizon and the Coryphodon Beds of the Eocene Wahsatch. The lower division of the Coryphodon Beds or Lower Wahsatch (Puerco) is clearly Tertiary, and the great break is between this horizon and the Ceratops Beds of the Laramie. Each of these faunas is now known by many species of vertebrate fossils represented by hundreds of specimens, and the more the two are compared the stronger becomes the contrast between them. Instead of placing them close together, as some geologists seem inclined to do, it will be more profitable in future to search for the great series of intervening strata containing the forms that lead from one to the other."

Both of these conclusions appear to the writer to be directly the reverse of the lesson taught by a comparison of the Laramie fauna with the Jurassic and the Puerco or basal division of the Eocene. The fact is, these Laramie mammals are surprisingly near those of the Puerco, and in some cases almost identical with them ; in other cases they are of a somewhat older type. Therefore, *the greatest gap to be filled by future discovery is between this Laramie fauna and the Jurassic.* For this Laramie fauna is separated from the Puerco about as widely as the Puerco is from the Wahsatch, but no more widely ; whereas it is separated by a profound gap from the Jurassic fauna, as proved, first, by a comparison of the general stages of evolution seen in mammals which belong to both periods ; second, by the advanced special evolution of the molar pattern, which is of a modern type in the Laramie, while it is wholly of antique type in the Jurassic, and finally by the difference between the typical modern or Eutherian dental formula seen in the Cretaceous, and the primitive formula found in the Jurassic.

A valuable key to the relative age of the Jurassic and Laramie faunas is seen in the stages of dental evolution of the Plagiaulacidæ. The Laramie stage is very close to that observed in the Puerco of America, and the Cernaysian of France. As long ago pointed out by the writer, these little mammals serve admirably to mark the progress of geological time by the absolute regularity of their evolution, indicated in the steady loss of the anterior premolars, by the regular addition of ridges to the fourth lower premolar, and of tubercles to the upper and lower molars.

COMPARATIVE TABLE OF THE PLAGIAULACIDÆ.

	JURASSIC.	CRETACEOUS.	LOWER EOCENE.	
	Purbeck.	Laramie.	Puerco.	Cernaysian.
Number of lower premolars.....	4–3	2	2–1	1
" grooves on pm. 4.....	7–9	11–14	12–15	14
" tubercles on first lower molar, outer, inner...	4–2	6–4	6–4	9–6

There can remain no doubt from this comparison that the Laramie Plagiaulacids stand much nearer the Puerco and Cernaysian types than they do to their Jurassic ancestors. In fact it is nearly impossible to distinguish the larger members of the Cretaceous *Ptilodus* from the Puerco *Ptilodus*; they are in substantially the same stage of dental evolution, and so nearly alike that the writer was for a long time tempted to believe that the Laramie and Puerco faunæ were contemporaneous. This must still be regarded as a possibility, although the Puerco in its exposure in northwestern New Mexico is plainly seen to overlie the Cretaceous.

We find entirely analogous proof of the gap between the Laramie and the Jurassic, and of the affinity of the Laramie with the Puerco among the Trituberculates, using this term to cover animals possibly belonging to the Marsupials, Insectivores, Creodonts, and the like.

COMPARATIVE TABLE OF JURASSIC AND UPPER CRETACEOUS TRITUBERCULATES.

	JURASSIC.	CRETACEOUS.	LOWER EOCENE.
	Purbeck.	Laramie.	Puerco.
Typical dental formula	4. 1. 4. 8.	?. 1. 4–5. 3.	3. 1. 4. 3.
Molar types.... ...	Triconodont and tritubercular, secodont only.	Tritubercular secodont and bunodont.	The same.
Upper Molars.......	High crowned.	Low crowned.	The same.
	No intermediate cusps.	Small intermediate cusps.	The same.
		No hypocone.	A hypocone, variable.
Lower Molars.......	Narrow spur-like talon cusp.	Broad heel-like talon, bearing 1–3 cusps.	The same.

In this table the transition from the Jurassic to the Laramie is seen to be very wide. In the Laramie the modern placental or marsupial dental formulæ are established—the teeth behind the canine are usually seven, and do not usually exceed eight. Marsh observes in one jaw what he considers five premolar alveoli. Second, out of the high crowned upper molars of the Jurassic, such as those of *Amblotherium* and *Spalacotherium*, a relatively low-crowned or bunodont tritubercular molar has been evolved; as this is a possible parent form of the ungulate and primate upper molars, it is an essentially Tertiary type. Third, the lower molars have evolved a broad talonid or heel, which in many cases present three cusps, whereas in Jurassic types the talonid is a spur or a narrow simple basin. Fourth, the trigonid, which is always very elevated in the Jurassic types, sinks in some cases to the level of the talonid—another modernization looking towards ungulate and primate ancestry.

Two features make the Laramie fauna appear more ancient than the Puerco: first, the non-development of an internal cingulum, which is common in the Puerco; second, the entire absence of the hypocone, which is quite strong in some Puerco mammals. On the other hand the upper and lower molars of Types *F*, *G*, *I*, *Cl*, respectively, are analogous to *Ectoconus*, *Dissacus*, *Diacodon* and *Haploconus* of the Puerco.

The zoölogical affinities of this fauna are at present hard to determine. *Ptilodus* and *Meniscoëssus* are still provisionally referred with the Multituberculates to the Monotremes. *Thlæodon* exhibits a jaw without an angle, and with a surprising resemblance to that of *Polymastodon;* the jaw is certainly neither of the typical placental nor of the marsupial type; this animal may therefore be provisionally considered a trituberculate Monotreme.

The placentals and marsupials, and the question whether one or both of these orders is represented in this fauna, is still unsettled. Not a single jaw has been found or reported sufficiently complete in the delicate region of the angle to determine positively its placental or marsupial structure. Portions of the jaws which are preserved indicate the presence of the marsupial type of inflection, while others point to distinct placental angulation.

BIBLIOGRAPHY.

E. D. COPE.—Mammalia in the Laramie Formation. <*American Naturalist*, October, 1882, pp. 830, 931.

On a New Genus of Mammalia from the Laramie Formation. <*American Naturalist*, September, 1892, pp. 758–762.

O. C. MARSH.—Discovery of Cretaceous Mammalia. <*American Journal of Science*, Part I, July, 1889, pp. 81–90; Part II, August, 1889, pp. 177–180; Part III, March, 1892, pp. 249–261.

Notes on Mesozoic Vertebrate Fossils. <*American Journal of Science*, August, 1892, pp. 171–176. (Determination of supposed premolar of *Meniscoëssus* Cope.)

Note on Mesozoic Mammalia. <*Proc. Acad. Nat. Sc. Phila.*, April 14, 1891.

H. F. OSBORN.—A Review of the 'Discovery of the Cretaceous Mammalia.' <*American Naturalist*, July, 1891, pp. 595–611.

A reply to Prof. O. C. Marsh's 'Note on Mesozoic Mammalia.' <*American Naturalist*, September, 1891.

The rise of the Mammalia in North America. <Vice-Presidential Address, American Assoc. Adv. Sci., Madison, Wis., Aug., 1892.

EXPLANATION OF PLATE.

PLATE VII.

Laramie Multituberculates.

[Sizes as indicated.]

1. *Ptilodus.*—First and second inferior molars ; on left side *in situ*, on right side reversed. These teeth belong to two individuals.

2. *Ptilodus.*—First and second inferior molars, worn considerably. These teeth belong to two individuals.

3. *Ptilodus.*—First superior molar of the left side

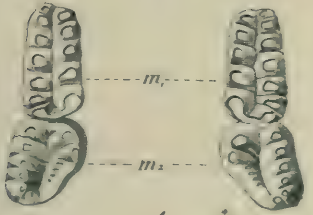
4. *Ptilodus.*—Fourth superior premolar, first and second molars placed together and reversed in outline to show probable relations. The three shaded teeth on the left side of drawing belong to three individuals

5, 6. *Ptilodus.*—External and superior views of two lower jaws, showing proportions of the teeth.

7. *Meniscoëssus.*—First and second inferior molars of two individuals placed together and reversed to exhibit the natural position.

8. *Meniscoëssus ? conquistus.*—First and second superior molars of two individuals placed together and reversed to show the natural position.

9. *Meniscoëssus.*—Composition side view of upper and lower dentition as far as known. Teeth and jaws combined from eight individuals. The superior premolars are not yet known with certainty.



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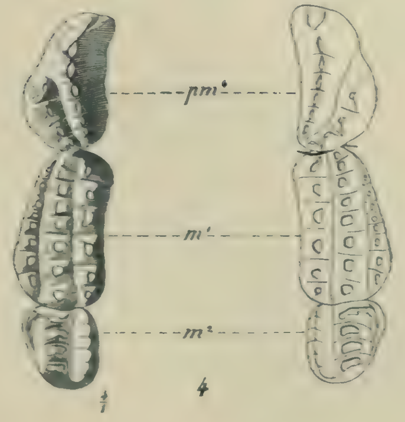

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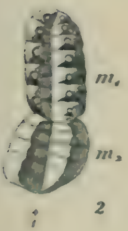

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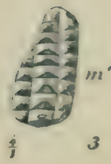

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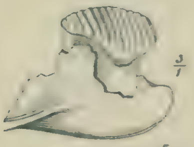

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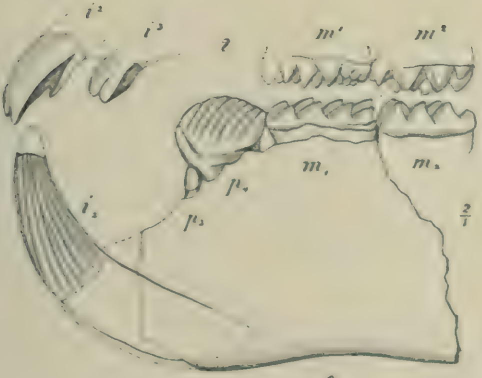
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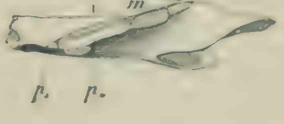
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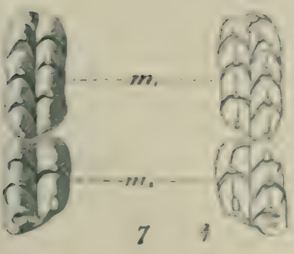

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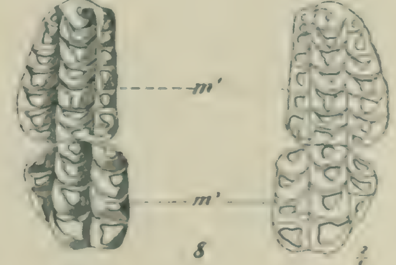

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UPPER CRETACEOUS MAMMALS.

EXPLANATION OF PLATE.

Plate VIII.

Laramie Trituberculates.

[All figures three times natural size.]

Abbreviations.—*pr*, protocone ; *pa*, paracone ; *me*, metacone ; *pl*, protoconule ; *ml*, metaconule ; *ps*, parastyle ; *mts*, metastyle ; *en*^{d}, entoconid ; *hl*^{d}, hypoconulid.

A.—Crown and side views of three superior molars, probably of the left side. Genus not determined.

B.—Crown views of four superior molars of the right and left sides. Genus *Pediomys* Marsh.

C.—A superior molar, and an inferior molar of the right side. Genus not determined.

D.—Crown and side views of two superior molars of the right side. Genus not determined.

E.—Crown view of a left superior molar. *Didelphops vorax* Marsh, after Marsh.

F.—Crown views of two superior molars, probably of the left side. Genus not determined.

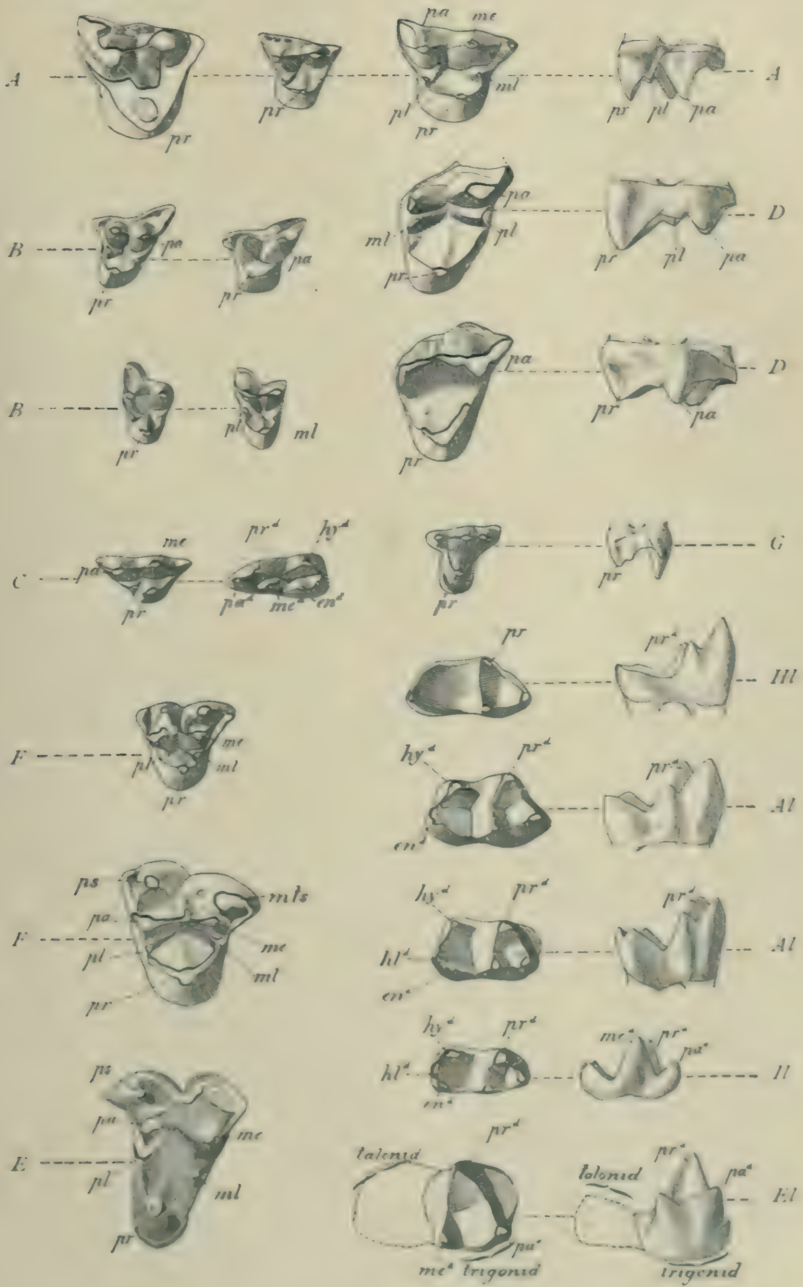
G.—Crown and side views of a superior molar. Genus not determined.

El.—An inferior molar of the left side. *? Didelphodon*. Crown and inside views.

Al.—Two inferior molars of the left side. Genus undetermined. Crown and inside views.

Hl.—Crown and inside views of a lower molar from the left side. Genus not determined.

Il.—Crown and inside views of a lower molar from the left side. Genus not determined.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UPPER CRETACEOUS MAMMALS.

Article XVIII.—DESCRIPTION OF A NEW MOUSE FROM SOUTHERN NEW MEXICO AND ARIZONA.

By Gerrit S. Miller, Jr.

Four skins of a species of White-footed Mouse, collected by Mr. A. W. Anthony, in Grant County, New Mexico, have for several years lain in my collection unidentified. The specimens appeared to represent an undescribed form, but lack of material for comparison made it unwise to attempt to name and characterize it. Through the kindness of Dr. J. A. Allen I now have before me a fine series of *Sitomys rowleyi* Allen, recently described in this Bulletin (*antea*, p. 74), and also the mice from Pinal County, Arizona, referred in the same paper with some hesitation to that species (l. c., p. 77). The Pinal County specimens are identical with those from Grant County, New Mexico. These two series taken together represent a form easily separable from *S. rowleyi*, and probably the Lower Sonoran representative of the latter. Although no distinctly intermediate specimens have yet come to light I prefer to treat the two animals as subspecies. Hence the new form may stand as :

Sitomys rowleyi pinalis, subsp. nov.

Smaller than *Sitomys rowleyi* Allen, with general coloring richer and more yellow. Cranium more highly arched than in *S. rowleyi*.

Adult Male (Type, No. 338, collection of Gerrit S. Miller, Jr.,[1] Granite Gap, Grant County, New Mexico, December 1, 1889; A. W. Anthony, collector) dorsal surface olive buff, deepening to buff yellow on the sides and becoming somewhat grayer on the head and face, the fur everywhere except in a narrow line separating the color of the back from that of the belly moderately shaded with sepia-tipped hairs which are most numerous over the rump and middle of the back ; an indistinct dark eye ring ; color of sides extending about to wrists and ankles, and completely surrounding base of tail ; dorsum of manus and pes and whole ventral surface pure white ; tail bicolor, hair brown dorsally and at tip, white ventrally, the hairs forming a distinct pencil and everywhere rather

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[[1] Mr. Miller has generously presented the type specimen of *Sitomys rowleyi pinalis* to the American Museum of Natural History, where it is now catalogued as No. [illegible].—J. A. A.]

long, but nowhere close enough to conceal the annuli ; ears very scantily clothed with exceedingly short silvery hairs ; whiskers reaching beyond shoulders, mixed dark brown and silvery gray.

An immature male (No. $\frac{1404}{646}$, Am. Mus. Nat. Hist., Pinal County, Arizona, December 2, 1885; W. E. D. Scott, collector) is smoke gray dorsally, fading into pure white on the ventral aspect, the back darkened as in the adult with sepia.

Older specimens have the colors of the adult appearing first on the sides, and then gradually replacing throughout the pelage the smoke gray which disappears last on the nape and occiput.

Unfortunately none of the specimens of *Sitomys rowleyi pinalis* were measured in the flesh ; but such measurements as can be obtained from the dry skins form a satisfactory basis for comparison with *S. rowleyi*, as shown by the following tables :

Sitomys rowleyi ALLEN.

LOCALITY.	NUMBER OF SPECIMENS.	HIND FOOT.			EAR FROM CROWN.		
		Max.	Min.	Average.	Max.	Min.	Average.
Bluff City, Utah.	11	23.0	21.2	21.98	16.2	14.0	15.76
Nolan's Ranch, " ..	4	22.4	21.2	21.95	16.0	14.8	15.30
Bradshaw, Ariz. ..	10	23.0	21.4	22.10	15.4	14.0	14.60

Sitomys rowleyi pinalis MILLER.

LOCALITY.	NUMBER OF SPECIMENS.	HIND FOOT.			EAR FROM CROWN.		
		Max.	Min.	Average.	Max.	Min.	Average.
Pinal Co., Arizona.	11	22.2	20.0	20.94	15.0	12.4	13.58
Grant Co., N. Mex.	4	21.6	21.0	21.25	12.4	12.4	13.50

Among fully adult individuals of *Sitomys rowleyi pinalis* there are no great variations in color. Some specimens are slightly more tinged with yellow than others ; and the tail varies from very sharply bicolor to but indistinctly so. The ventral surface is without exception pure white with no indication of a pectoral spot.

As compared with *Sytomys rowleyi* this form is distinguishable in color by its yellower back and sides. The back is sometimes more heavily shaded with sepia than in *S. rowleyi*, but this character is inconstant. The buff stripe separating the color of the back from that of the belly is noticeably brighter in *S. rowleyi pinalis* than in *S. rowleyi*. In both species the fur is everywhere blackish slate at base, but this color is perhaps a shade darker in *Sitomys rowleyi pinalis*. The soles in both animals are haired to about the same extent, namely from the heel to within about two millimeters of the proximal tubercle.[1]

The skull of *Sitomys rowleyi pinalis* is smaller than that of *S. rowleyi* with brain-case narrower and less flattened. The characters are such as might be due in part at least to age, but the average of good series of specimens of each form show differences too marked to be ignored. The average basilar length of fifteen skulls of *S. rowleyi pinalis* is 21.9 mm.; maximum 23.0; minimum, 20.8. Seventeen skulls of *S. rowleyi* give: average 23.6; maximum 24; minimum 22.4. The ratio of parieto-basioccipital depth to mastoid width varies in *S. rowleyi pinalis* (sixteen specimens) from 65.0 to 71.6, average 68.07; in *S. rowleyi* (eighteen specimens) from 60.0 to 65.3, average 62.22. In general form the skull of *Sitomys rowleyi pinalis* approaches that of *S. americanus*, while the cranium of *S. rowleyi* is so flattened as to resemble that of *S. eremicus*, *S. fraterculus*, or *S. californicus*. The long, slender nasal bones, extending well back of the nasal branches of the premaxillaries, will, however, at once distinguish the skull of *S. rowleyi* from that of *S. eremicus* and its allies. In dentition and in the form of the mandible, *Sitomys rowleyi* and *S. rowleyi pinalis* agree perfectly.

Mr. Scott has, so far as I know, made no notes on the habits of this mouse as observed by him in Arizona. He states, however, on the label of a specimen taken December 4, 1885, that the uterus of this individual contained three two-thirds grown embryos. Regarding the specimens taken at Granite Gap, Mr. Anthony writes as follows: "They were caught in a drift of big granite boulders—hardly a cliff, but answering all the requirements, I suppose. The country immediately surrounding was thickly covered with the dry desert grasses, and used as a stock range. The *Hesperomys* subsist largely on the seeds and perhaps also on the dry stems of these rank grasses, and I think, when in season, the 'Mesquite' beans form a part of their diet."

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[1] The statement in the diagnosis of *S. rowleyi*: "Soles entirely naked as in *S. eremicus*" is incorrect. The true condition is alluded to in the fourth paragraph on page 77, l. c.

Article XIX.—DESCRIPTION OF A NEW MOUSE FROM LAKE COUNTY, CALIFORNIA.

By J. A. ALLEN.

Sitomys robustus, sp. nov.

Similar in proportions and coloration to *Sitomys americanus gambelii*, but nearly twice the bulk of that form; hence about equaling *S. gilberti* in size, but differing from the latter in much smaller ears and much shorter tail, and also in coloration.

Above uniform dull yellowish brown, much varied with blackish, the pelage being plumbeous at base, subterminally broadly ringed with fulvous and tipped with blackish; middle of back darkest, gradually becoming more fulvous on the sides, without, however, forming a distinct fulvous lateral line nor a distinct dorsal band of dusky; beneath white, as also the upper surface of both fore and hind feet. Ears moderate, in size, form, color and hairiness about as in *S. a. gambelii*. Feet large; soles sparsely haired posterior to the last tubercle. Tail a little shorter than head and body, sharply bicolor, dusky brown above and white below, fairly well clothed with short hairs and non-penicillate—about as in *S. americanus*.

Measurements.—Two specimens, both males, and measured in the flesh by the collector, give the following dimensions: Total length, 174–175 mm.; head and body, 94–102; tail,[1] 73–80; hind foot, 21–22; ear, 19–21.

Skull.—Of the size and general proportions of *Sitomys gilberti*, or of small specimens of *S. californicus*, except that the auditory bullæ are markedly smaller, being scarcely larger than in average specimens of *S. a. gambelii*, notwithstanding the much larger size of the skull. In other respects there appear to be no tangible cranial differences. Total length of the type (the other skull is imperfect), 26 mm.; basal length (posterior base of incisors to posterior border of occipital condyle), 22; greatest width of brain-case, 12.5; least interorbital breadth, 4.5; length of nasals, 10; length of lower jaw, 13.5; length of lower jaw to tip of incisors, 16; height at coronoid process, 6.

Type, No. 282, Mus. Leland Stanford University, Lakeport, Lake Co., Cal., March 20, 1893; collector, S. Parrish.

This species is based on two adult males, in the museum of the Leland Stanford University, collected by Mr. S. Parrish at Lakeport, Lake Co., California, March 20, 1893, kindly placed at my disposal for study by Prof. Charles H. Gilbert, of Stanford University. These specimens were at first regarded as greatly overstuffed examples of *S. a. gambelii*, till an examination of their skulls showed the fact to be otherwise. *S. robustus* requires no comparison with other species beyond that already made, its short tail, relatively small ears, robust body, large feet, and small auditory bullæ, at once serving to distinguish it. It would seem, however, to much resemble *S. boylii* in size and coloration, but the latter is described as having a much longer tail—much longer than head and body instead of much shorter, as in the present species.

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[1] It is barely possible that the extreme tip of the tail in both specimens was mutilated in life, but it seems by no means probable.

Article XX.—DESCRIPTION OF A NEW SPECIES OF GEOMYS FROM COSTA RICA.

By J. A. Allen.

A specimen of *Geomys*, collected at Santa Clara, Costa Rica, by Mr. George K. Cherrie, has recently been received from that gentleman for identification, which on examination appears to be undescribed. It belongs to the *G. hispidus* section of the group, but differs from it markedly in size, coloration and in the character of the pelage. It may be described as follows :

Geomys cherriei,[1] sp. nov.

Above everywhere blackish chocolate brown, except a large patch of pure white on the crown, subtriangular in shape, 30 mm. in length and 6 to 17 mm. in breadth, broadest behind ; inner surface of fore and hind limbs, throat and breast, dusky grayish ; rest of lower surface pale grayish buff. Tail (except extreme basal portion), and upper surface of both fore and hind feet naked, apparently reddish in life.

Measurements (approximate from dried skin) : Total length, 275 mm. ; head and body, 195 ; tail, 80 (naked portion, 65) ; hind foot, 40 ; middle claw of same, 5 ; fore foot, 34 ; middle claw of same (arc of curve), 15.

Skull, total length, 60 ; basal length (posterior border of occipital condyle to posterior base of incisors), 47 ; zygomatic breadth, 34 ; occipital breadth, 30 ; length of nasals, 20 ; lower jaw (posterior border of condyle to posterior surface of incisor), 38 ; height at coronoid process, 17.

Type, No. 664, Museo Nacional de Costa Rica, Santa Clara, Costa Rica, October, 1892 ; George K. Cherrie.

The specimen described above is evidently about full grown, but the sutures of the skull indicate a rather young animal. The skull is of the heavy, short, broad type of *G. hispidus*,[1] with the malar greatly expanded. The coloration of the animal, however, is much darker, especially below ; the pelage is rather soft and not hispid, and the tail is relatively much longer than in *hispidus*. The white patch on the crown is possibly albinism, but if normal is a striking feature.

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[1] Named for Mr. George K. Cherrie, Acting-Curator of Birds and Mammals, Museo Nacional de Costa Rica, the discoverer of the species, and to whose kindness I am greatly indebted for mammalogical material from Costa Rica.

In addition to the differences in external characters and in size, *G. cherriei* differs from *G. hispidus* in several important cranial details, notably in respect to the shape and size of interparietal bone, which in *G. hispidus* is broad and short (much broader than long), and gently convex in front, while in *G. cherriei* it is narrow, subtriangular, and nearly twice as long as broad.

Possibly this species may need comparison with *Geomys heterodus* Peters, from Irazú, Costa Rica ; but Alston says (Biol. Cent. Am., Mam., p. 160) that Peters's type "proves identical with Mexican specimens."

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[1] I am indebted to Dr. C. Hart Merriam, Chief of Division of Ornithology and Mammalogy, U. S. Department of Agriculture, for a specimen of *G. hispidus* for comparison in the present connection. Dr. Merriam writes me that this specimen "may be regarded as a *duplicate* type [of *G. hispidus*], since it was collected at a point probably not more than six miles from the exact spot where the original type was obtained."

Article XXI.—DESCRIPTION OF TWO NEW RACES OF MAMMALS FROM FLORIDA, WITH REMARKS ON SITOMYS NIVEIVENTRIS CHAPMAN.[1]

By Frank M. Chapman.

Scalops aquaticus australis, subsp. nov.

Char. Subsp.—Similar to *Scalops aquaticus*, but averaging slightly browner and constantly much smaller.

Description of Type (Coll. Am. Mus. Nat. Hist., No. $\frac{3216}{2906}$, Gainesville, Florida, May 4, 1891; F. M. Chapman).—Pelage soft and full, silvery grayish brown; upper surface of fore feet and hind feet very scantily covered with short whitish hairs; tail with a few longer grayish hairs.

Measurements.—From the fresh specimen, total length, 148 mm.; hind foot, 17; tail, 22.

While the characters which distinguish this race are to be found mainly in its small size, they are too striking to be ignored. Of the five specimens of *australis* in the American Museum Collection only two were measured in the flesh; the remaining three are, however, evidently quite as small. The flesh measurements of the two specimens compared with those of five specimens of *S. aquaticus* from the vicinity of New York City are as follows:

	Total Length.	Tail.	Hind Foot.
S. aquaticus	163	28	20
S. a. australis	**142**	**21.5**	**16.5**

The comparative cranial measurements of the two forms are as follows:

	Basal Length	Mastoid Breadth.	Interorbital Constriction	Posterior Margin of Last Molar to Posterior Base of Incisor.	Palatal Breadth.
S. aquaticus	32.5	17.5	7.2	13.4	5.4
S. a. australis	**28.5**	**15.7**	**7**	**11.7**	**5**

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[1] *Hesperomys niveiventris* Chapman, Bull. Am. Mus. Nat. Hist., II, 1889, p. 117.

Sitomys niveiventris subgriseus, subsp. nov.

Char. Subsp.—Similar to *Sitomys niveiventris*, but smaller, darker, and with the hairs of the underparts plumbeous at the base.

Description of Type (Coll. Am. Mus. Nat. Hist., No. $\frac{1745}{1025}$, adult male, Gainesville, Florida, January 30, 1889; F. M. Chapman).—Above between wood-brown and cinnamon,[1] very sharply defined from the under surface, clearer about the face and sides, mixed with blackish on the back, forming an indistinctly defined darker, median dorsal area; underparts, including the feet, white, the hairs basally plumbeous; whiskers rather scanty; ears proportionally rather large, both surfaces finely covered with short, silvery white hairs; tail short, bicolor, very sparsely haired and without an appreciable pencil; soles of the hind feet naked, except at the heel, which, with the tibiæ for a space of 4 mm. from the heel and the upper surface of both front and hind feet, is thinly covered with short hairs.

Measurements.—From the fresh specimen, total length, 122 mm; tail vertebræ, 45. From the skin, hind foot, 16.5; height of ear at anterior base, 13; height from crown, 9; greatest width, 9.

The female resembles the male both in color and size; young specimens are smoke-gray above somewhat darker dorsally and with a buffy tinge about the nose.

Beyond having a shorter and relatively broader skull than *S. niveiventris* this new form apparently does not differ cranially from that species. The differences in size are shown by the following measurements. Average of three males and three females of *S. niveiventris*, measured in the flesh: total length, 142 mm.; tail vertebræ, 52. Average of seven males and seven females of *S. n. subgriseus:* total length, 123 mm.; tail vertebræ, 43. Cranial measurements from the same specimens are:

	Basal Length.[2]	Mastoid Breadth.	Interorbital Constriction.	Nasals.	Crown Surface of Upper Molars.
S. niveiventris..........	19.6	9.4	3.6	9.5	3.3
S. n. subgriseus........	17.8	9.1	3.5	8.2	3

This little mouse is exceedingly common in the vicinity of Gainesville. It inhabits cleared fields, particularly those which are under cultivation, cornfields being among its favorite haunts. It lives in holes in the ground, and so far as I observed does not close the entrance to its home. Signs of its presence are therefore readily observable, and traps set at the mouths of its burrows will generally catch several individuals. A female taken January 30, 1889, contained three half-grown embryos.

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[1] *Cf.* Ridgway, Nomenclature of Colors.

[2] From the posterior margin of the occipital condyle to the posterior base of the incisors.

The haunts of this species and of *Sitomys americanus gossypinus* were as sharply defined as were the wooded or cleared areas. The latter was never found in perfectly cleared fields, while the former did not occur in wooded tracts. In the 'deadenings,' however, where the trees are killed by girdling, and the crops are planted beneath them, both species were found together, *subgriseus* living in its underground retreats, while *gossypinus* occupied hollow trees or decaying logs.

This difference in haunts is paralleled by the local distribution of *Sitomys niveiventris* and *S. a. gossypinus* on the east peninsula of Indian River. There *niveiventris* is confined to the immediate vicinity of the beach where the only growth is the low, scrub palmetto (*Chamærops serrulata*). In ground of this nature *gossypinus* is rare or wanting, but as one goes inland the palmetto gradually gives way to live oak, and at the same time *gossypinus* replaces *niveiventris*. The paler coloration of *niveiventris* as compared with *subgriseus* is thus presumably due to the nature of its haunts.

Sitomys niveiventris and its representative interior race *S. n. subgriseus*, bear no close relationship to any known member of the genus to which they belong. With the exception of the diminutive *Sitomys taylori* (Thomas) of Southern Texas they are the smallest members of the genus which have thus far been described. As compared with *Sitomys americanus*, their prominent external characters, aside from color, are their smaller size, relatively shorter tail and longer hind feet, and shorter pelage.

Cranial differences are apparently to be found only in size and proportions. *S. niveiventris* and *S. n. subgriseus* have a relatively broader skull than has *S. americanus*, and the brain-case is more depressed posteriorly; the ascending arch of the maxillary is actually as wide as that of *S. americanus*, and therefore is relatively wider.

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ERRATA.

Page 27, line 2 from bottom, for Tachico read Pachico.
" 28, lines 6 and 18 from bottom, for Sonora read Chihuahua.
" 33, last line, for **Callipepla elegans** (*Less.*) read **Callipepla elegans bensoni** *Ridgw.*
" 127, lines 10 and 29 from top, for Sclater read Sharpe.
" 128, lines 11 and 27 from top, for Sclater read Sharpe.

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